THE SOUND ENGINEERING MAGAZINE

JUNE 1980
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Coming Next Month

• The July issue of **db** is a continuation of our three-part series on Radio and Recording. Part II will feature special emphasis on studio construction for all types of budgets. Also, included in the July issue, as a special treat to our readers, is a Directory of Construction Services. Then, Norman Crowhurst continues his discussion of human hearing in "A.G.C. and Other Things." So be prepared for an action-packed issue of **db—The Sound Engineering Magazine.**

About The Cover

• Fantasy Film's newest film mixing facility in Berkeley, California, features a three-man computerized Harrison mixing console, seven levels of theater seating, and an extensive integration of acoustical, electrical, and mechanical systems. Acoustic design by Jeff Cooper of Los Angeles. As of press time, **db** has learned that Fantasy Films has been renamed Saul Zaentz Film Center. (Photo by William Lovi)

db

THE SOUND ENGINEERING MAGAZINE

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db is listed in **Current Contents: Engineering and Technology**

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db Letters

TO THE EDITOR:

I read with eagerness Norman Crowhurst's article, "Grounds and Hum," in the February issue of **db.** It is interesting to see how we got where we are today. In the section on ground loops, though, he neglects to give us a cure to the problem of the amp and preamp with metal chassis touching each other. Obviously, setting a copy of your fine magazine in between the units would isolate them, but what if they are mounted in an EIA metal rack (as used in laboratories or portable sound reinforcement, i.e. multiple power amp configuration)? There must be a way to eliminate ground loops without wrapping each amp in insulation material, not to mention the metal screws holding the units against the metal rack rails. I would appreciate hearing from anyone who knows the answer to this problem.

GARY GAND
Sound Engineer

db Replies:

The February column, about Grounds and Hum, brought more reader responses than usual, of which the above is one. It seems my mistake was in thinking that modern applied technology had "cured" all the hum problems from which we used to suffer: apparently some people still suffer!

To answer this question, there must be only one ground connected between two chassis where signal passes from one to the other. If that connection is by contact of the chassis with the rack frame, then there must be no ground connection between the internal circuitry, through the signal interconnection.

In general, this means that the input of the power amp, in the example he quoted, will be grounded, but the output from the preamp should not be. Of course the input to the preamp is grounded, and that ground line will carry through to the output, in many modern circuits. In this case, the input to the power amp should not *be grounded, except through the preamp ground line.*

When a ground line passes through circuits covering such a large gain, you may run into a ground line hum, which is not due to a loop, but to residual supply hum causing hum potentials in the ground line itself, that get amplified. This calls for extremely careful design of the internal circuitry of each unit involved, to avoid even extremely low level ground line

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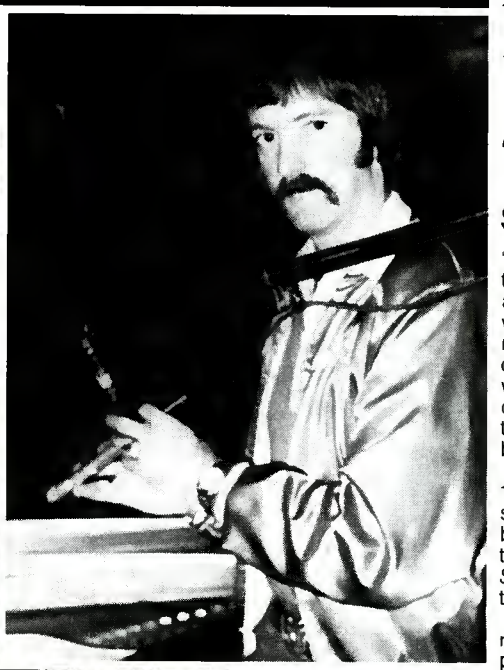

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Dennis Hetzendorfer,
Staff Engineer

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"The SM81 really changed our minds about the ruggedness of condenser microphones. It's a precision piece of equipment, but it's durable. You don't always think about a studio microphone needing durability...after all, we don't have the rough handling problems encountered in concert recording. But, when you have a reputation as one of the most technically exacting studios in the country, you appreciate how *many* little things can subtly affect the sound of a delicate condenser microphone. The SM81 sounds good *every* time we use it...and, at Criteria, as in any good studio, we just can't afford to have a microphone we can't depend on.

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hum, which I fully believed everyone had taken care of by now, when I wrote the February column.

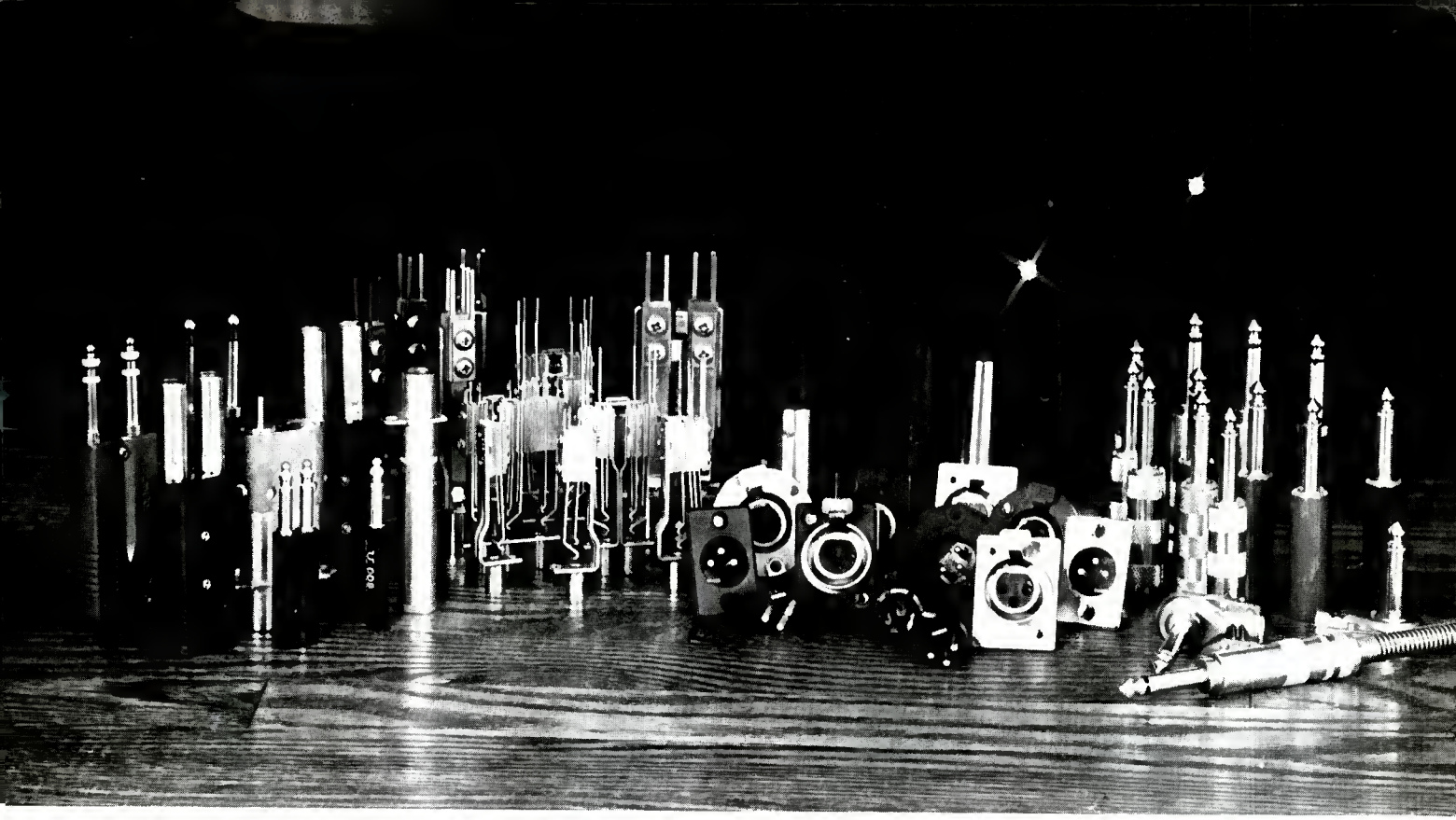
If you encounter a case where this is not true, that is, where hum is still not acceptable low when you un-ground the power amp input as suggested above, then you need to shop around for a combination of preamp and amp where it can be done. It is too complicated a task, amounting to virtual redesign of the amplifiers' circuits (which is totally impractical with etched circuit boards), for you to tackle "after the event" so to speak. The designer must have already done that for you.

TO THE EDITOR:

This letter is to comment on the article "Distortion Measuring Microphones for Music Recording," in the January 1980 issue.

The use of omni-directional microphones for over-all pickups in recording is simply based on a gross misunderstanding of how microphones relate to their acoustical environment. Permit me to excerpt some passages from the booklet "Microphones" by Dr. Gerhart Bore, Physicist of the Neumann Company (available from Gotham for $1.00), since it is stated there most eloquently. "The sonic impression recorded by a microphone will be determined not only by its free field (0 degrees) measured response, but also by its diffuse-field response. The latter is the response to sound which reach the microphone, somewhat delayed, about equally from all directions in the room. The diffuse-field frequency response even for microphones which—depending on room size—are placed more than 0.5 m to 2 m distant, has a greater effect on the over-all sound than is usually assumed. Better grade up-to-date microphones are required to have virtually parallel running free-field and diffuse-field responses. By changing the microphone to sound source distance, the "reverberation balance" (the direct sound to room reverberation ratio) may be changed without, at the same time, changing the frequency response. This requirement is fulfilled properly by only a few of the more recent *pressure gradient* microphones.

In pressure microphones (inclusive of all measurement microphones), the frequency response curves for the free-field and diffuse-field *never match!* It might be well to point out here that Neumann was the manufacturer of Calibrating Microphones long before B&K even existed and indeed built the condenser measurement capsules which Hewlett-Packard supplied with their real-time analyzers. Yet nobody ever even considered using these incredibly flat response, quiet, phase response linear microphones for studio work. I guess there is a big difference between people knowledgeable in the application



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of microphones to measurement work and studio engineers.

As for claim of high sensitivity (whatever that means), wide dynamic range and low distortion: The dynamic range of condenser microphones is a function of capsule output and amplifier noise. The larger the capsule the greater the output. Neumann builds predominantly studio microphones with large diameter capsules, while measurement microphones, usually designed for extended high frequency response above 20 kHz, must be kept small in diameter. But all that aside. The application says it all. Neumann makes only one pressure response microphone: the KM 83, and we hardly ever sell one. Must be something about the directional units Neumann has been building for 50 years that make them more useful.

STEPHEN TEMMER
Gotham Audio Corporation
741 Washington Street
New York, New York

db Replies:

Microphones for music recording and concert use come—and with good reason—in several different basic designs. While it was not intended to be within the scope of the article to fully describe how instrumentation (omnidirectional) microphones relate to the acoustical environment, it is probably true that there is some (perhaps even gross) misunderstanding on this point. This may arise from some old-fashioned, stereotyped notion as to what modern day omnidirectional and pressure gradient high quality microphones really are and how each type is best applied.

It is likely that there is some difference between people working with measuring microphones and studio engineers. However, the major objective for both groups of people is really the same: To convert a sound signal into an electrical signal as accurately as possible. I certainly noticed the above excerpt in my German version of Dr. Bore's booklet and can only agree that certain high quality pressure gradient microphones are well suited in applications where they are used at some distance from the sound source, where the sound field consists not only of the direct field but also, to a significant degree, of a reverberant field.

Since studio engineers in general are familiar with the advantages of pressure gradient microphones, it seems likely to describe some areas where omnidirectional measuring microphones can be used with advantage as compared to pressure gradient microphones:

1. *Close miking applications in the studio and on-stage. This is a situation where the direction of the direct sound field is well defined and the level of the reverberant sound is deliberately kept low. This is an ideal application for a measuring microphone of the free-field type (flat 0° incidence response) for*

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two reasons; (a) the proximity effect problem inherent in pressure gradient microphones does not exist, and (b) close miking means in general higher SPLs. Measuring microphones have larger overload margins—20-40 dB depending on the type.

2. *Miking of amplified instruments. In this type of application the microphone is very often placed close to the instrument, and the same reasoning as in item (1) applies.*

   As an aside, it should be noted that just about all omnidirectional studio microphones have a peak at the high end of the frequency response, due to pressure build-up (KM 83: approx. +6 dB at 8 kHz), meaning they have not been compensated for 0° incidence response. This is a disadvantage in the applications outlined in items (1) and (2). This type of response normally yields a good random incidence response. Measuring microphones exist both in flat random incidence models and in flat 0° incidence response types. The random incidence microphones appear to be most useful where the sound field is overwhelmingly reverberant and diffuse.

3. *Miking of percussive instruments. Here the inherent simple design of measuring microphones, their extended low and high frequency response and linear phase response, make them highly applicable for this use. Since pressure gradient microphones are much more complicated internally with acoustical delay lines, low resonance frequency, etc., they inherently have a poorer phase characteristic. Also, in pressure gradient microphones the sound impinges on the diaphragm from the front as well as from behind through a second entry located some distance away from the diaphragm. This dual acoustical path with its associated time delay means that the microphone does not start to function properly as a pressure gradient microphone until sound has reached the backside of the diaphragm some time after reaching the front of the diaphragm. This means distortion of transient sounds, showing up as too high a level at the onset of the sound, thus changing the timbre.*

To The Editor:

Enclosed you will find my personal check for $9.00. Please enter my subscription to **db** Magazine. If possible, would you backdate this subscription to January 1, 1980 and send me any back issues that I have missed. If not, please begin my subscription immediately.

If I may, I would also like to ask a technical question. I own two Revox A-77 Mik III recorders; one is a standard speed quarter-track unit, and the other is a high speed half-track unit. I am concerned about optimizing the bias for the lowest distortion and the highest signal to noise ratio. The service manual is not much help along these lines as it covers tape that I do not use. I normally use Ampex 406, 407, or 456.

Is there a way using my signal generator (Heathkit IG-1272) and oscilloscope (RCA W091A) that I can be SURE that I am getting the maximum performance from my decks on whatever tape I use?

Or, to put this question another way, how would a professional engineer in a studio optimize the bias for his Ampex, or Scully, or Studer? Surely he would not pull out his little service manual and find "Ampex 456" and the column "15 ips" and read, "drop the bias 2 db"!

Any help you can give me here would be greatly appreciated.

Jim Tountas
Big Spring, Tx.

db Replies:

Your subscription is in the works, and the back issues are on their way to you.

As to your technical question, the professional engineer surely would *pull*

con·stănt di·rec·tiv'i·ty

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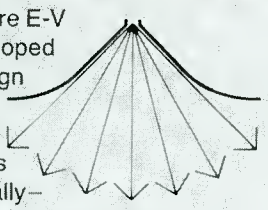

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Write to Electro-Voice for more information. We'll send you a complete set of Engineering Data Sheets and a paper comparing the today performance of HR constant directivity horns with yesterday's promises. Include $1 with your request, and we will put you on the mailing list for the E-V "PA Bible," a down-to-earth series of papers on the selection and application of professional PA products and concepts!

[1] U.S. Patent Number 4071112

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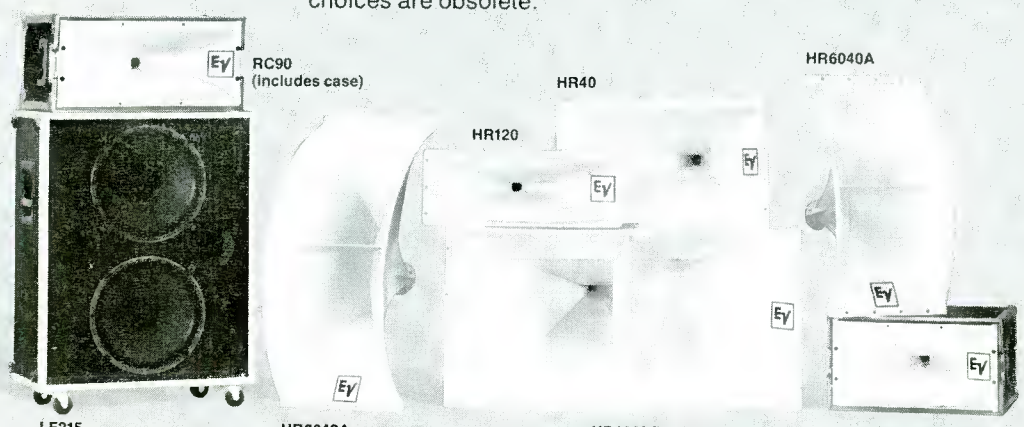

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out his manual, unless he happened to recall the proper settings for his preferred tape and tape recorder. For example, Ampex recommends overbiasing (at 10kHz, 15 ips) by anywhere from 1 to 3 dB, depending on your machine's record gap dimension (406, 407, 456 tapes). For further details on tape specifications, biasing and such, check the January 1979 issue of **db.**

TO THE EDITOR:

In Ross Macdonald's letter (April issue) criticizing my reply, he credits himself with ideas he espouses, of introducing counter-distortion, to reduce resultant non-linear distortion, as his own original. I have records of a patent application, made in my name, assigned to Fairchild Recording, in 1954, that did precisely what he describes. Why would I deny that it works?

However, that patent was denied, because someone had done it before me, which puts that original work a long way before his papers about it, in the late 50s and early 60s. And he still overlooks one important point that we discovered in our work during the early 50s: you cannot *eliminate* distortion by that method. His first letter claimed that *any* desired degree of reduction could be achieved by this method.

For example, distortion due to second order curvature, the kind that adds second harmonic, can be reduced by reverse second order curvature. Now suppose each is 10 percent in magnitude and they exactly balance, as far as second is concerned: there will still be 10 percent of 10 percent, or 1 percent, of fourth harmonic in the final output.

His whole argument takes my original statement, a long while ago now, out of context. In fact, by adding a slight modification to either of our statements, we actually agree: you can *reduce* distortion, only if you have, *either* the input waveform to use as reference, *or* precise knowledge of the amount, type and phase of the distortion occurring.

I still do not understand why he claims the omitted second alternative as something about which I was wrong, when I did it before he did, and even I wasn't the first, as the patent examiner found.

NORMAN H. CROWHURST
One-time Electronic
Engineer!

TO THE EDITOR:

I am going to build a professional acoustic recording studio. Could you please recommend some books concerning how to build an acoustic studio for such recording purposes, remember a *professional* one.

Please state the price and freight for each copy. I'm waiting for your letter and thanking you in advance.

KUMARA PRASETYA
JL. Progo 111-52
Semarang, Indonesia

db Replies:

We have strong misgivings about suggesting that anyone try to build a professional studio "by the book." However, see John Woram's article in this month's issue for some capsule reviews of some books that may help you.

You may also want to contact Wilkinson-Murray, Ltd., 56 Meriday Street, Chatswood NSW 2067 Australia. According to the NCAC Directory (also discussed in the above article), the company has affiliated firms in Singapore and Malaysia. Although they do not seem to specialize in recording studios, perhaps they can refer you to someone nearby who does.

Good luck, and keep in touch as your studio progresses.

TO THE EDITOR:

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Newington, Conn. This is a Model 602-C. I need some data on this instrument such as the schematic showing the input impedance and output impedance, etc.

Apparently the business has been sold to another company and the old name dropped. Perhaps your close contact with electronic firms will enable you to give me the new company that has this former firm and the *new address* to use. Thank you kindly for your help.

ERNIE GARRISON
Assoc. AES Member
827 Village Place
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db Calendar

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15-18 **1980 International Summer Consumer Electronics Show (CES),** Chicago, IL. McCormick Place, McCormick Inn, and Pick-Congress Hotel. For more information contact: William T. Glasgow, Vice President, Consumer Electronics Shows, Two Illinois Center—Suite 1607, 233 N. Michigan Avenue, Chicago, Illinois 60601 (312) 861-1040.

15-18 **Annual Consumer Electronics Design and Engineering Exhibition;** held concurrently with the **1980 International Summer Consumer Electronics Show** at the McCormick Place/McCormick Inn/Pick-Congress Hotel in Chicago. For more information contact: Electronics Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006. (202) 457-4992.

19-20 **APRS '80** International Exhibition of Professional Recording Equipment. Connaught Rooms, London, England. For more information contact: British Information Services, 845 Third Avenue, New York, NY 10022, (212) 752-8400.

23-27 **B&K Measurement Seminar—Industrial Noise Control I.** B&K Instruments, Inc., 5111 W. 164th St., Cleveland, Ohio 44142. Telephone: (216) 267-4800.

30 **The New England Conservatory of Music** opens its summer session highlighting workshops, courses, and master classes. Various guest lecturers will also be featured during the session. For more information contact the New England Conservatory of Music, 290 Huntington Avenue, Boston, Mass. 02115, (617) 262-1120.

JULY

1-3 **Transducer and Temperature Control Exhibition** will be held at Wembley Conference Center, London, England. For more information contact: British Information Services, 845 Third Avenue, New York, NY 10022, (212) 752-8400.

25-27 **American Radio Relay League 26th Convention,** Seattle, Washington. Registration and program information may be obtained by writing 1980 ARRL National Convention Committee, P.O. Box 58534, Seattle, Washington 98168.

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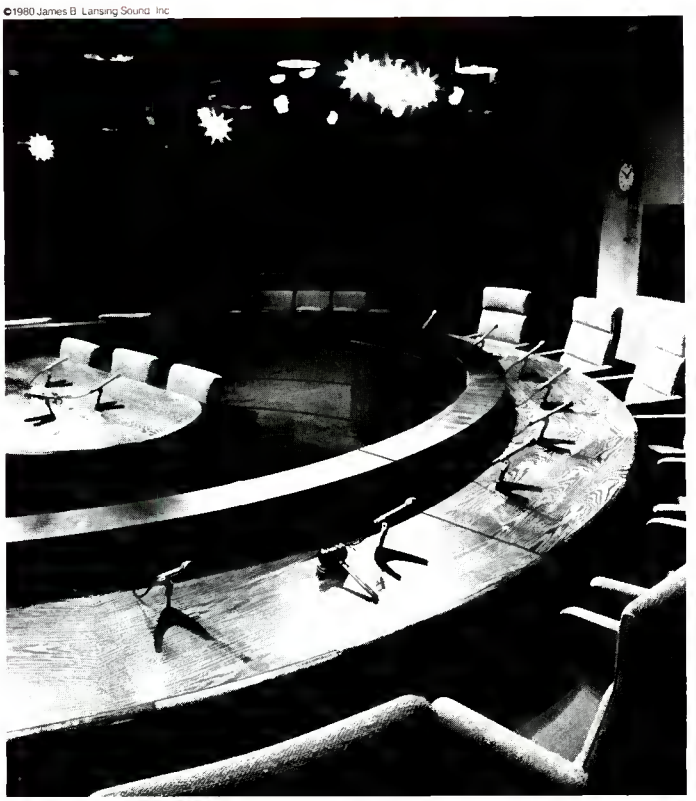
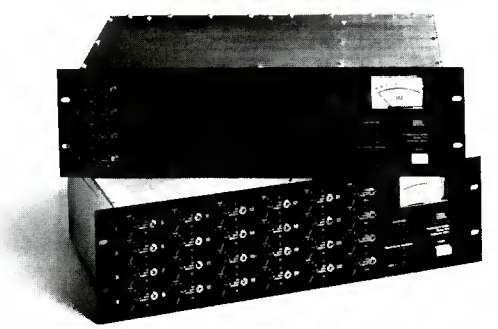
Load Impedance	600 ohms or higher loads
Total Harmonic Distortion	
Mic In to Direct Out	0.01% at +21 dBm
Mic In to Main Out	0.1% at +21 dBm
Automatic Mic Functions	
Input Rise Time	30-60 nS
Input Release Time	100 mS to 5 S, adjustable

JBL First with the pros.





Circle 20 on Reader Service Card

NORMAN H. CROWHURST

db Theory & Practice

Systems: People and Machines

• Last month we finished on an interesting note, that we want to pursue here: the possibility of "bypassing" the analog part of the human ear. People with an engineering background tend to balk at this idea, as impossible, so let us think about that. The objection is that the complex digital signals, that the auditory nerve bundle communicates to the brain, is so complex, that we would never be able to "break the code," much less synthesize it, so that we can simulate sounds, without even producing them.

ILLUSION

In this area, perhaps video is ahead of audio, in one or two ways. Computers can program video circuits to produce all kinds of wonderful effect, that only take form on the screen of a TV tube, all done electronically and, essentially, using digital techniques. But that is done by machine, does not involve breaking into a "living" system, such as the transformer mechanism between the middle ear and the auditory nerve.

However continuity of image is maintained, in human sight—and it obviously does not involve a scanning system like that used for TV—the video systems all use electronic synthesis that, to present the picture to our minds, must translate

that into a visual illusion of the special type that was originally developed for TV. All the while the picture is built up by means of a spot that scans the area vertically and horizontally, in sequence, what we see is an illusion. And the modern video technology works with that illusion. It does not create pictures, replicas of the reality we see everyday, in space.

TRUE SOUND?

Audio systems, on the other hand, are less of an illusion: they do recreate sound waves, that come into our ears. There is some deception, that creates a satisfactory illusion, but it takes place in a different area of the system. To clarify this, let us look at system design principles. Perhaps a good example would be the development of the audio system —all of it—to the form we know today. The overall problem is to recreate a satisfactory illusion of the original sound we want to convey to human hearing, in analog waves.

In the early days, we hadn't much notion of how to proceed. We knew that we started with acoustic sound waves, and we wanted to finish up with acoustic sound waves. And, because we were dealing with analog signals, everything was referenced in analog terms: frequency, amplitude, synthesis of both, and the avoidance of distortion products. Then we had conversions from acoustical signals to electrical signals and back again.

The first systems didn't even have electrical signals: they went from acoustic to mechanical, and back, on the original acoustic phonographs. But then interposition of electrical handling, with electronic amplification improved the potential, and eliminated a lot of the mechanical problems. But developing it was a struggle that the younger generation take for granted, because somebody before them "got it all solved."

There was a learning process. The machines didn't learn: people did, those who designed the machines. We found that certain levels of distortion were acceptable, as we have told before, only to find later that, when you got around to improving another part of the system, those same levels were not acceptable. In the early phonographs, the weight on the playing stylus, which in those days was called a "needle," was measured in ounces. Had they tried the grams that we use today, routinely, the pickup would have blown away.

THE RISE OF STEREO

But there were improvements of a stereo nature: from monaural to 2-channel, and now to 4-channel. And that introduced the need for a concept that is very basic to systems design, as well as to what we want to pursue here: compatibility. Monaural records had been

around a long while, and there were millions of them out there, that people would not want to throw away. Stereo must come in a way that would enable people to ease into it, rather than scrapping everything they already had.

There was another reason for this, in those days. Had today's stereo come on the scene, fully developed in all its quality, maybe people would have thrown their monophonic systems away and gone for stereo. But it was very like the early days of color photography in motion pictures: color was spectacular, mainly because it was new, but the quality picture makers stayed with black and white, because for the time, it was better. Color was ludicrous and, at times, course. Fine grain black and white was far better.

Just as with stereo, that is no longer true. Stereo recordings have now achieved a quality seldom if ever attained in the old monophonic days. That has come about by a progressive systems improvement, a step at a time. And at various stages, compatibility became very important, to make the transition.

ONLY HUMANS CAN LEARN

Now we need to introduce a basic distinction, that should be obvious, but that can be overlooked. Machines do only what they are designed to do: they have no learning capability. As we said earlier, only people, living creatures, learn. Wait for it, I'll probably get some arguments about that. Shall I say more now, or wait for those contradictions? Let me compromise by offering this comment: it may be true that computers or other machines can be made that are capable of a form of learning; but their learning is restricted to an area programmed into them by their human designers.

Living people, and even animals, perhaps to a lesser extent, but we sometimes wonder about that, have no limit to their learning. Today's generation may be more limited, in effect, than any people in living history, because the school system has insisted on adopting a programming technique, instead of true education. But underneath that hard veneer is a creature that can still learn, in the true sense.

Some examples may reinforce this. There are medical histories of people who have lost faculties in various ways. Most of us think of seeing and hearing as something we were born with, did not have to learn. We recognize that we must have had to learn language, both spoken and written, because we may have some memory of that process, and because for all of us, there are some things we don't know in that area. We only know the familiar symbols, those we have learned to identify and use.

But a person who has suffered amnesia, unless they recover, has to learn language all over again (unless the amnesia was selective). A person who has suffered other functional losses, may recover, and have to learn all over again, to walk, or whatever function was lost. Who would have thought that thalidomide babies, born without arms and legs, could learn to use artificial limbs? Yet they are doing it.

The artificial limb cannot learn anything. The person who used it must do the learning. And there are instances where optical or hearing diseases have resulted in loss of the optic or auditory nerve function which, when restored, requires the person to learn to see or hear, all over again.

We look, or listen, and imagine that the world we see, so beautifully ordered, must create that ordered image in our brain, just as a camera produces an image on its focal plane. And the eye does produce such an image on the retina of the eye. But from there it must be conveyed to the brain by the large optic nerve, in some form of code. Our own personal code has become so much a part of us, that we "see" the image, in the context of thousands of other such sets of signals that the optic nerve has sent to the brain.

LEARNING TO IDENTIFY

The same is true of hearing. We hear sounds that we learn to identify. We were not born with that capability. The automobile mechanic, for example, has a different learning capability from the rest of us. He can listen to an engine running, and hear a sloppy camshaft that the rest of us would never hear at all, however carefully it was described to us.

The maestro who conducts an orchestra can hear components of sound in the program he conducts that you or I could never hear—although at the same time his hearing may have become impaired, due to constant listening to those same sounds, at a higher level than you or I normally listen to them.

HEARING AND VISION: SOME INTERESTING COMPARISONS

Much of the research that has been conducted into both vision and hearing, tends to view those faculties as objectively as we look at machine counterparts, cameras, microphones, and so forth. But that approach causes us to overlook the important function of the learning process by which we utilize those faculties. We think of our eyes as cameras, and our ears as microphones, neither of which is completely true. Both of them are incomplete: the image we think we see or hear, is due to something derived from the retina of the eye, or the cochlea of the ear, and transmitted, in a quite different form, to the brain.

So, is it possible that eventually man will find a way to convey those signals to the brain, without the intermediary of a human camera or microphone, the eye or the ear?

If such a possibility depended, like the telephone repair crew depends, when patching up a ruptured line consisting of thousands of pairs, on correctly matching each pair, so the signal went to its correct destination, we would agree that such a task seems insurmountable, because the optic or auditory nerve is infinitely more complex than such a multiple telephone circuit.

And what about the new optical fiber process, that the telephone companies are gradually adopting? Now they can send thousands, maybe millions of signals down a single optical conductor, instead of requiring a great many electrical pairs. But really, that is going in the opposite direction from a simulation of human faculty capacity: putting a much greater signal, through a single "conductor," rather than using much slower "conductors" in multiple coding.

Only by thinking in such system terms, will we approach the objective we suggested at the beginning. Will it involve learning, like learning to see or hear did? Possibly. And maybe the learning process will be relatively quick. Have you ever viewed one of those stereoscopic slides where, when you first look at it, you see a double image? If it is too far "off," your eyesight may not be able to pull it in. But if it is only a little off, you will feel your eye muscles "pulling," and the whole picture will come into focus, with all its perspective depth. Think about that.

The muscular effort necessary to align the "images" conveyed to the brain, presumably, is analog. But that sense of depth, once they are aligned, is produced by the comparator in the brain, that even computes relative distances in depth. Just as your hearing can separate out sounds by a similar comparison made between signals fed to it by the auditory nerves from your two ears.

As we write this, we cannot help the feeling that we are on the verge of a whole new technology. What are dreams made of? Do images appear on the retina, or are the sounds we hear in our dreams generated in the cochlea? True sounds that impinge on our ears in reality are sometimes linked with dreams as we wake up. But, admit it, there's still a lot we don't really know, and as we learn, the possibilities for doing something with what we learn are endless. ■

MARTIN DICKSTEIN

db Sound With Images

Multi-Media/Multi-Image Equipment

• Recent surveys have shown that the slide medium is by far the largest image medium, far surpassing both video and film. It is being used in more places for more things with more objectives than any of the others. Now, with some of the latest equipment that has been put into the hands of program developers and designers, it is possible to make slide shows look like films, mix slides and films in the same show, and create effects that could come close to challenging the versatility of the video control consoles.

TECHNIQUES OF MULTI-IMAGE

Another poll recently taken of attendees at a convention, which had seminars and equipment displays, indicated that the greatest interest lay in slides and the techniques involved in multi-image. Among the new equipment, interest was highest in the new AVL Raven, followed shortly by the Clear Light Micro Star 3, and a little bit farther down the list by AVL's Eagle. Among companies mentioned, AVL came out first. So, for those of you who may not be familiar with some of this equipment, we thought this might be a good time to offer some idea on what these items are, only to whet your appetite and not satiate you, and not as an endorsement of any item or company. We'll also mention one item not on the list.

MULTI-IMAGE VS. MULTI-MEDIA

Before we do that, let's see briefly what the distinction is between multi-image and multi-media. In the "olden" days (although it is still going on) a single slide projector was used for slide shows. Once the dissolver came into being, and two projectors were tied together to eliminate the black-screen pause between images, the simplest form of multi-image began. This happened on a single screen. That is, one image followed another on one screen. It had been possible to use two or more screens, with one slide projector for each screen, thus making a single multi-image presentation. Now, with a dissolver for each screen, two or more projectors could be tied together and a lot more action was possible across as many screens as desired.

AUTOMATIC PROGRAMMING?

With the introduction of programmers, shows could be run automatically, and the further development of computer programmmers led to memory systems, digital readouts, fraction-of-second movement, the use of many slide projectors on many screens, and multi-image as it exists today. So far, we've talked only about one medium—slides.

To many people, running a simple slide show, then stopping to play a film, then continuing with slides, is a multi-media show. True; two media are being used. But films and slides cannot be mixed in rapid sequence unless some means is used to synchronize the speed of the audio tape (which carries the cues for the march of the slides) with the speed of the film projector. Once the means was developed to do this, film and slides could be mixed with accurate timing. The next step was to design a unit which would control the film projector so well and so accurately, that tricks could be played with the film speed. This is where we are now, with multi-image, multi-screen, multi-media presentations.

PACIFIC MICRO SYSTEMS

Now, let's take a look first at the item not on the list. A company called Pacific Micro Systems has just come out with a real-time programmer for two slide projectors that just about fits the palm of the hand. It is the PMS 1201 dissolver/programmer. In a 1.5 lb. unit, 1¾" x 5" x 7", they have incorporated 25 dissolve rates; from ¼ sec. to 5 mins.; flashing capability at any desired rate; "reverse" to return to the previous slide; and "timer" which permits any dissolve to take place, then advances the dark projector, and continues this effect at any specified delay time to automatically repeat the sequence until stopped. There is also a "pause" which stops a dissolve at any time during the process and keeps both images on the screen, a "toggle" which stops a dissolve and starts it in the reverse direction so the two images fade in and out over each other without changing slides, and "flip" which prevents the dark projector at the end of a dissolve from advancing. There are other possibilities as well with LED readout to provide operation status. An animation effect can also be created by using "alternate." This causes two images to alternate rapidly on the screen with no

slide change, to give a simple animation effect such as an eye opening and closing, or winking at the audience.

AVL

The company mentioned most, AVL, is based in New Jersey. They have a full line of slide projector control and programming equipment. There are other manufacturers who also have such devices available. Among them are Spindler/Sauppe, Arion, Clear Light, and Kimchuck. But AVL did come out with the item mentioned most—the Raven. This unit permits the intermix of slides and film as never before possible. By using a 16mm film projector which can be used for analysis work, or a standard model which has been modified with a DC motor (and a few other things), the Raven can be programmed into a presentation to show film at different predetermined speeds, to change speed during a film, to stop at a precise frame, to start again instantly, to synchronize its speed with the control unit so that it will either speed up or slow down unnoticeably, and to mix these various capabilities on as many screens as desired with the use of one Raven per screen.

This same company has also developed the Eagle, consisting of a high resolution nine-inch closed circuit TV monitor displaying cues and status of the system, a keyboard which is used to program the cues and tell the controlled units what to do and when, and the floppy disk containing all the information for programming any show. The disk can take up to 30,000 cues in a show, and can read a program in three seconds. The Eagle itself is a general purpose, non-dedicated digital computer. It can operate as a computer for any purpose which is dictated by the disk which is inserted. By using AV information, the device is made applicable for controlling slide and film equipment.

This programmer can be used with other equipment by the same manufacturer to operate any number of slide projectors with as many cues as desired. When a selected operation is typed into the keyboard, in code (to save typing time), the display shows the cue and spells out what the code means to give complete readout of what has been programmed into the memory. If the cue is incorrect (or "does not compute," as they say) the readout shows the cue with a question mark to ask the programmer to change the cue to a correct one.

By using the Eagle, associated with dissolvers and the Raven, a complete program can be put into memory, played back, corrected, put on a tape, and kept up to date whenever desired. When the units comprising the Eagle are put into one cabinet, the manufacturer calls it the Golden Eagle. It may take some time to learn how to talk to the computer, but once that is done, the programming can be done in "leisure" time, that is without the audio track running while the cueing is being done, to create some eye—and mind-boggling effects.

CLEAR LIGHT

Another manufacturer of programming equipment is Clear Light. They have produced the Star 2 and Star 3 systems, for two and three, and up to fifteen projectors. The Micro Star 3 system incorporates the features of the parent Star 3 system (which runs up to fifteen projectors) in a compact memory programmer for three projectors. An LED display indicates what step is needed next. The dissolve rates are indicated numerically. Other commands are shown by letters. Status lights show operational modes.

There are 11 dissolve rates ranging from hard cut to 24 seconds. Also included among the dissolve rates is an exclusive "soft cut." A looping feature will continue a repeated animation sequence until stopped. The unit can be set for two- or three-projector operation for up to five screens, and is compatible with other units of the same manufacturer. The programmer operates either in real time or memory, and is capable of 512 cues, but because the "loop" repetitions do not require additional cue space, the overall capability can be considered to be over 150,000 cues.

db New Literature

TESTING AND DESIGN

• A new 36-page catalog entitled "Instruments for Testing and Design" is now being offered for interested persons. A variety of new products such as a Universal Counter-Timer, bench top frequency counter and a multiple-threshold logic state indicator are among the few. **Mfr: Continental Specialties Corporation, 70 Fulton Terrace, New Haven, Conn. 06509.**

NOISE MEASUREMENT

• A 24-page illustrated 4-color brochure contains descriptions and condensed specifications for a product family of noise measurement instruments, including sound-level meters, noise dosimeters, noise analyzers, and acoustic calibrators. Additionally, it offers a brief step-by-step approach to noise measurement focusing on the following problems: measuring noise correctly; identifying who is affected by noise; understanding the frequency components of noise; determining if instruments are measuring noise correctly. **Mfr: GenRad, Inc., 300 Baker Avenue, Concord, Massachusetts 01742.**

INSTRUMENTS

• A full line of electronic instruments are illustrated and described in a new 44-page catalog for 1980. Complete information is given, including: major features of interest to users, detailed description, and complete technical specifications—performance ranges and limits, power required, weight and physical dimensions. Included in the catalog are digital multimeters, solid state VolyOhmyst multimeters, VOM's, power supplies, isolation transformers and much more. **Mfr: VIZ Manufacturing, 335 East Price Street, Philadelphia, Pennsylvania 19144.**

DIGITAL MASTERING

• Performance characteristics and detailed specifications of the 3M Digital Mastering System are described in a new brochure available from the Mincom Division. The system makes possible production of records from tapes that are virtually free of noise and distortion and delivers a 90dB-plus signal-to-noise ratio. The tapes lack signal deterioration or noise buildup on multiple-generation copies made during dubbing and mixdown. **Mfr: 3M, PO Box 33600, Department MN80-12, St. Paul, Minnesota 55133.**

MICROWAVE COMPONENTS

• A new catalog featuring microwave components has just been issued to serve the needs of the microwave industry. The catalog, MC/180, features an extended line of coaxial switches. Also included are waveguide switches, dummy loads, crystal detectors, bolometers, and RF micropotentiometers. **Mfr: Micronetics, Inc., 36 Oak Street, Norwood, New Jersey 07648.**

SEMICONDUCTOR GUIDE

• The new 1980 edition of the Archer Semiconductor Replacement Guide, featuring cross reference/substitution listings for over 100,000 devices was recently made available. The 224-page book is a comprehensive guide of the complete line of Archer semiconductors and includes detailed data and pin connections for IC's diodes, SCR's, led's and other devices. The cross reference/replacement listings were all compiled by computer to assure accuracy. **Mfr: Radio Shack, One Tandy Center, Ft. Worth, Texas 76102.**

PRODUCT CATALOG

• Just off the press is a new 1980-81 product catalog containing a complete listing of the entire line of TransZorb silicon transient voltage suppressors, NPN switching transistors, Zener diodes, temperature compensated diodes, and highspeed, high voltage switching transistors. Over 250 new devices are included. This 286-page catalog contains detailed descriptions of characterization and applications information for many of the devices listed. **Mfr: General Semiconductor Industries, Inc., PO Box 3078, Tempe, Arizona 85281.**

TEST ACCESSORIES

• A new electronics test accessories catalog is now available. Products covered include banana plugs, jacks and patch cords; phone tip jacks, plugs and connecting cords; test clips, probes, and holders; binding posts, black boxes and sockets; molded patch cords, cable assemblies, test socket adapters; ¾ inch spaced molded accessories, molded test leads and connecting leads. Special features are a new products index, conversion tables of temperatures, and many other charts and conversions. **Mfr: ITT Pomona Electronics, 1500 East Ninth Street, Pomona, California 91766.**

sound with images (cont.)

Both the AVL and Clear Light systems have their own trademarked methods for assuring complete synchronization of each slide drum with the programming cues (even after re-lamping during a show), and both have the capability of coming out with a hard copy (programming printed on paper) of the entire show's cues for future reference, and correction when desired.

IN THE FUTURE...

As we said, multi-image multi-media shows have come a long way in a short space of time. Professional programmers, experts who know the equipment capabilities and how to talk with the computer keyboards or control consoles, can almost challenge the electronic wizardry of a video control expert. Quite a few equipment manufacturers can brag of the capabilities of their systems in terms of creatable effects, ease of operation, "simplicity" of programming, etc. With multi-screens, multi-imagination, and multi-money, almost anything (on second thought, leave out the "almost") will be possible. Remember, the multi-image philosophy and industry is still in its crawling stage. There's a lot more to come. And, like with any new creative medium, it will be some time yet before the insatiable audience cries multi-enough. Remember, there's always a new audience growing up. ■

The world's most advanced hand-held wireless microphone

After three years of extensive research, Vega proudly announces two all-new hand-held wireless microphones designed for use by discriminating professional performers, or anyone who must have superior sound quality without a mic cable. These microphones are a substantial improvement over all previous hand-held wireless mics, offering not only top audio performance, but also a revolutionary case/antenna system. Because the antenna is incorporated into the microphone housing, unsightly dangling wires and "rubber duckies" have been eliminated. This new design assures that the RF output is equal to, or better than, that which could be achieved with an external antenna—no matter how the microphone is held. Light weight and a gracefully contoured shape contribute to the mic's comfortable, well-balanced feel.

The Model 80 is equipped with an Electro-Voice EV-671 mic capsule, and the Model 81 utilizes a Shure SM-58 capsule. Due to very low distortion and a flat transmitter-to-receiver frequency response of ±2 dB from 40 Hz to 15 kHz (±1 dB 100 Hz to 12 kHz), the sound is as clear as you would expect from the best of conventional hard-wired microphones. Used with a Vega "Dynex" receiver, overall system dynamic range is better than 90 dB, eliminating the mixer gain control riding and distortion caused by compresion and clipping. (The mics are available without Dynex for compatibility with older Vega receivers or those of different manufacture.)

Both models use a standard 9V alkaline battery, offering from 7 to 9 hours continuous use, and a range of up to 1000 feet. Since operation is in the 150 to 216 MHz VHF range, there is no interference from CB radios or FM broadcast stations in normal use. An audio gain control on the bottom of the case lets the user adjust the mic's sensitivity. Optimum setup can be verified with an adjacent LED indicator that doubles as a battery monitor. The mics also include a Power On/Off switch, plus a separate Audio On/Off switch so you can keep the receiver quiet when you want to temporarily silence the mic.

When new techniques are developed . . . they're from Vega.

Cetec Vega
Division of Cetec Corporation
P.O. Box 5348 • El Monte, CA 91731 • (213) 442-0782 • TWX: 910-587-3539

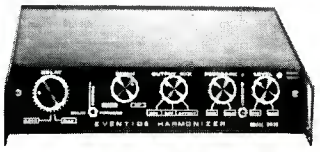
Circle 19 on Reader Service Card

db New Products & Services

MIXER

• The Model 269 Compact Mixer/Console is available in formats ranging from 17x1 to 14x4. Adaptable to a wide range of applications the Model 269 may be mounted in a console or portable carrying case, and can be powered by standard AC, internal NiCads or even 12V DC for mobile studios. Completely modular construction simplifies diagnosis and servicing, and permits rapid changes in input/output configuration. Controls include separate low and high-frequency equalizers with a ± 16 dB range, plus a presence equalizer (± 11 dB) whose center frequency is continuously tunable from 150 to 7,000 Hz. The Model 269 also has independently-metered variable-recovery-rate limiters, complete reverb-send, foldback, and pan pots, and solo, muting, and slating facilities. There is also a built-in condenser talkback mike and a pre-fade monitor amp. Six-step switches adjust input sensitivity from -61 to +4 dBu (0 dBu = 0.775V), and the floating ground XLR connectors provide phantom powering, as well.
Mfr: Studer Revox Inc.
Circle 50 on Reader Service Card

HARMONIZER

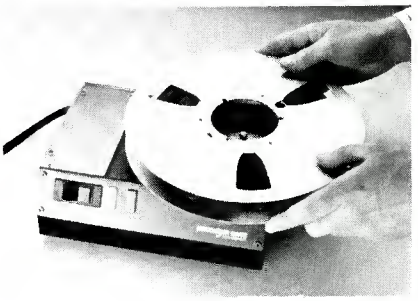


• The HM80 Harmonizer, a compact unit with a full range of features was recently introduced. Some of the features include pitch changing from one octave up to one octave down, delay from 0 to 270 msec, feedback control, mixing of effect plus dry signal, repeat, and reverse. The HM80 has a frequency response of 10 kHz, a dynamic range of 80 dB, accepts line or guitar level input, and weighs less than three pounds.
Mfr: Eventide Clockworks, Inc.
Price: $775
Circle 52 on Reader Service Card

DISTRIBUTION AMPLIFIER

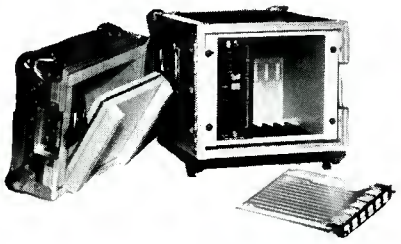
• The Model 7823, Microphone/Line Distribution Amplifier, includes the Model 4003 transformer coupled Microphone Preamplifier with adjustable gain to 65dB; and the Model 4820 balanced output Distribution Amplifier which drives eight 600 ohm lines at +20dBm. A separate line level transformer coupled uninterrupted output from the Microphone Pre-Amplifier is always available. A source select switch enables the 7823 to be alternately used from a line level source through its balanced, bridging differential input. An 80dB isolation between outputs with an extremely low noise and distortion are achieved through the use of MAP Audio Op-Amps.
Mfr: Modular Audio Products
Circle 51 on Reader Service Card

BULK ERASER



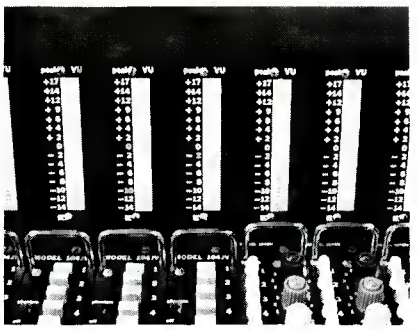
• The QM-250 Bulk Tape Eraser completely demagnitizes commonly used professional tapes including cassette, ¼ inch, ½ inch, and one inch open reel, broadcast 8-track cartridge, and ½VHS/Beta cartridges. The QM-250 is a compact unit weighing only 11 pounds but will hold reel sizes up to 10½ inch.
Mfr: Recorder Care
Circle 53 on Reader Service Card

MINI-RACK



• The producers of the Scamp Signal Processing Sysytem have further updated the technology with the introduction of the Mini-rack. Musicians can configure a Mini-Rack with their favorite Scamp Modules and, using the SO2 Microphone Pre-Amp, direct inject a low level; the format is ideal for rental companies and for on-location film work because of its portability. The new Minirack will hold up to six modules excluding the Power Supply unit. The Minirack is built into a robust flight case. External connections can be made via another module. the S12 TT Jack Module.
Mfr: Audio & Design Recording, Inc.
Circle 54 on Reader Service Card

LED/VU INDICATORS



• A new series of high technology led/VU indicators have been developed. The unit was constructed as a three inch bar graph on a 3.5 x 1 inch bezel. A fast attack makes these indicators read peak level, so that headroom can be inferred directly. Slower decay prevents missing a fast peak. Bright wide-angle rectangular led's in blocks allow easy viewing under all light conditions and from any angle. Integrated level-sensors mean small simple reliable circuit. Indicator shows 15 levels from –14 to +17 dB in approximately 2 dB steps using 30 leds, with a 1 volt sine wave reading zero dB with a 1500 ohm input resistor. Calibration can be changed by altering the input resistor, as with an ordinary VU meter. Power requirement is 10 to 15 volts at 250 ma.
Mfr: Interface Electronics
Price: $100
Circle 56 on Reader Service Card

P.A. SPEAKER

• The new PA-88 Public Address Speaker System is said to employ the latest in sound reinforcement engineering and design techology for high sensitivity and efficiency. The PA-88 features a controlled dispersion design that allows microphones to be positioned with greater freedom and fewer feedback problems. The unit features two eight-inch woofers for extra bass power handling, and a high-output piezoelectric tweeter for smooth high-frequency response. Frequency response is rated at 95 to 18,000 Hz.
Mfr: Radio Shack
Price: $79.95
Circle 58 on Reader Service Card

RING RADIATOR

• For high definition and sound reproduction in the high frequency region, the Vortec HF-3000 Ring Radiator Tweeter offers up-to-the-minute technology. The HF3000 is a fluid-cooled bullet radiator able to reproduce the harmonics and timbre integral to faithful and articulate sound reproduction from 3.5-20 kHz.
Mfr: Integrated Sound Systems
Circle 55 on Reader Service Card

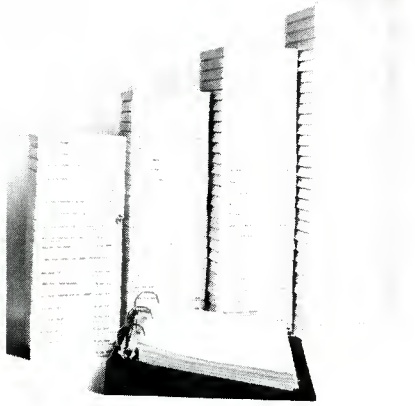
CONSOLE

• The Series 30 Recording Console has been designed to implement most the features and performance of its mentor Series 1600 console, in a smaller size and at a much lower cost. The Series 30 comes equipped with 8, 16, or 24 discrete output channels and 8 active mix busses. Mainframe sizes of up to 36 inputs are available, permitting console configurations ranging from 12x8 to 36x32.
Mfr: Sound Workshop
Circle 57 on Reader Service Card

DIGITAL EDITING SYSTEM

• This Digital Editing System consists of a compact console (21½ x 6½ x 5 inches) of microprocessor electronics offering extreme precision, risk-free audition or edit preview capability, unaltered originals and splice-free masters. The control module, which determines and monitors the tape movement of two recorders, offers special function buttons for determining exact editing points. Refinement can be made by as little as one one-thousandth of a second.
Mfr: 3M, Inc.
Circle 59 on Reader Service Card

SOUND EFFECTS

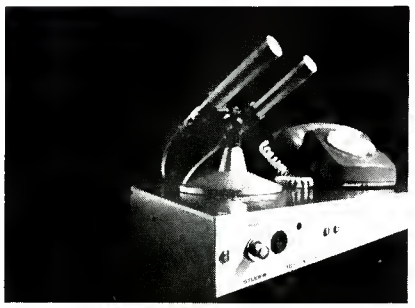


• A sound effects library containing over 2,200 fully-catalogued effects was recently introduced. The library offers over 20 hours of recorded sound effects. The 100 boxed reels of high quality recording tape is available in either 19 or 38 cps (7½ or 15 ips) playing speeds. All recordings were done on location or in the studio, not transferred from disc.
Mfr: Sound Ideas
Price: $1,500 (7½ ips)
$1,750 (15 ips)
Circle 60 on Reader Service Card

PROGRAMMABLE EQUALIZER

• A new programmable equalizer stores and recalls 28 sets of EQ curves and level settings from its own internal memory. It is a competely self contained system, using a microcomputer to manage the affairs of a 4-band analog parametric equalizer. With this Model 2800 it is possible to pull the plug and take a sound from the studio to the cutting room. The Model 2800 is available in single and dual channel versions.
Mfr: 360 Systems
Price: $1415 (one channel)
$1730 (two channel)
Circle 61 on Reader Service Card

TELEPHONE LINE INTERFACE



• The Telephone Hybrid Unit, a compact, rack-mountable interface between studio console and telephone lines, permits their voice, as well as the voices of moderators and announcers, to be heard clearly and without distortion. The Telephone Hybrid Unit consists of three basic elements: a "receive" circuit which amplifies the callers voice signal to a standard balanced, floating output, as required by studio consoles, a "transmit" circuit which converts the announcers voice back to acceptable telephone line signal voltage and connects the telephone line so the caller can hear the announcer's voice, and finally a "hybrid" circuit which suppresses the high levels of distortion that are a byproduct of telephone transmission of two voices simultaneously.
Mfr: Studer Revox Inc.
Circle 62 on Reader Service Card

E SERIES

• The E Series is the new line of products upgraded from the original K Series. In addition to featuring SFG magnetic structures, all E Series models are built with new high-temperature adhesives, plastic materials and optimally constructed voice coil formers. These features allow for increased efficiency, greater dynamic range and increased power handling capability throughout the line. The E Series consists of the following models: the E110, a 10-inch loudspeaker for lead or rhythm guitar, keyboards, voice or line array; the E120 12-inch and E-130 15-inch for similar applications. The E140 15-inch, E145 15-inch and E151 18-inch, are for electric bass or organ.
Mfr: James B. Lansing Sound, Inc.
Circle 63 on Reader Service Card

MULTIMETER

• The "Tech DMM" Model WD-747, 3½ digit multimeter comes in a compact bright orange, high impact plastic case. It may be used to measure DC and AC voltage, DC current (up to 10 amp.), resistance and transistor hFE. The WD-747 has a built-in socket and circuitry space for testing transistor hFE, the only 3½ space DMM which does. All functions are color-coded to reduce risk of operator error. The unit comes complete with 9V battery, deluxe probes and spare fuse.
Mfr: VIZ Mfg. Inc.
Price: $89.95
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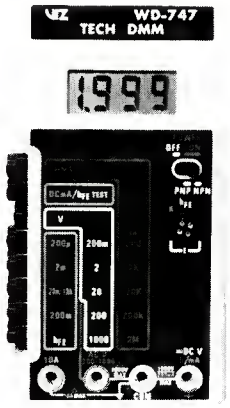

SOUND-LEVEL METER

• The 1988 Precision Integrating Sound-Level Meter and Analyzer is a versatile, lightweight precision sound-level meter and octave-band analyzer that automatically calculates equivalent continuous sound levels and sound exposure. The unit features a built-in microprocessor.
Mfr: GenRad
Price: $2950
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SOUND PROJECTOR

• The Model BIA-100 Sound Projector introduces a unitized bi-axial wide-angle sound projection concept that eliminates phase cancellation, and offers a unique gimbal-mount that permits focusing the sound within a 180° directional arch. Molded of high-strength non-resonant structural foam, the BIA-100 features internal twin parallel air columns that ensure lobe-free and uniform dispersion. Specifications include a 130° horizontal and 60° vertical dispersion; low-frequency roll-off at 200 Hz; air column length-32 inches; and sound pressure level—132 dB.
Mfr: Atlas Sound
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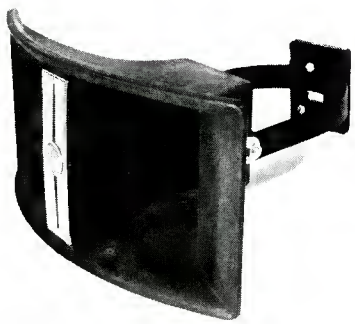

LOUDSPEAKER

• The new three way Model 310 loudspeaker was recently introduced featuring extended low frequency—3db down point at 27 Hz. Designed to eliminate the necessity for a separate sub-woofer or low frequency synthesizer, the Model 310 offers a half-octave lower frequency response than other "large bookshelf" speakers. Its wideband response is 84dB SPL output at 1 watt and 1 meter. Other features include response deviation of less than ± 1.5dB over a frequency range of 30 to 20,000 Hz.
Mfr: Cambridge Physics
Price: $349. ea.
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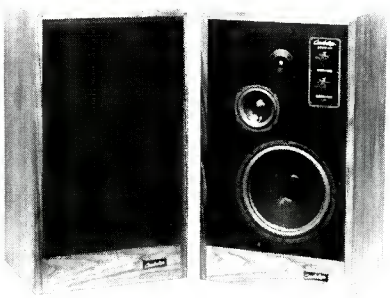

Radio and Recording—Part I

THIS MONTH, we begin our three-part series on radio and recording, with an issue highlighting architectural acoustics. Next month, we'll have a look at studio construction, and in August, we conclude the series with features on studio systems. That "Radio and Recording" heading simply means that—although our emphasis is on the recording studio—much of the information contained in these three issues pertains to the broadcast studio as well.

For example, Don and Carolyn Davis' discussion of TDS, ETC, FTC and TEF should interest the designer of any studio—recording or broadcast. The feature is an applications-oriented description of some of Richard Heyser's pioneering work in this area. As the hardware gets more sophisticated, the hardware-checking techniques must keep pace, and Heyser seems to be having no trouble at all staying one step ahead of things.

Our authors are of course well-known for their long-running Syn-Aud-Con seminar series (see the **db** calendar in most issues), and for their work in the development of the "live end-dead end" TM control room. As for all those initials, they're fully explained in the article.

Michael Rettinger, author of *Acoustic Design and Noise Control* (see **db**'s book page), is certainly no stranger to architectural acoustics, or to **db** readers. In this month's issue, Rettinger states his reservations about some recent trends in control room design, preferring to keep the area surrounding the loudspeakers reflective, rather than absorptive.

Which is it to be then; live-end or dead-end? Rettinger knows, and so will you, after reading *A Live-End Environment For Control Room Loudspeakers.*

If you're about to build your own studio at last, hold on a minute! There are many books (including a new edition of Rettinger's) and consultants available that may help make the job just a little bit easier. Before breaking ground, you may want to read one or more of the books we've reviewed this month—or consider hiring outside help. Our brief feature, *Books on Architectural Acoustics for the Would-be Studio Designer,* will give you a glimpse of what's available.

And speaking of consultants, what happens when four of them meet in a crowded room? Actually, it was quite peaceful, and there was no blood shed after all. The occasion was the recent SPARS convention, where panelists George Augspurger, Brian Cornfield, Jeff Cooper and John Storyk offered their views on *Recording Studio Design and Acoustics.* We've excerpted parts of the seminar, which took place in Los Angeles last month.

And from Texas comes word of what's happening at Indian Creek Recording Studio. Surely an acoustician's delight, Indian Creek did not have to contend with noisy neighbors, flight patterns, railroads, and all the other little distractions well-known to urban studios.

June is also APRS month. That's the Association of Professional Recording Studios, in England. The APRS holds its annual exhibition in London this month, and to celebrate the event, we asked John Borwick to prepare a brief guide to the latest in pro' audio hardware from the U.K. note that Borwick offers representative costs in Pounds Sterling. As these words are being type-set, the conversion rate is $2.21 per British Pound. However, this is a rough estimate at best, since fluctuating exchange rates, import duties and what-not must all be factored in. So, for a more accurate quotation, contact the various U.S. reps listed by Borwick. (Tell 'em **db** sent you!)

By the way, complimentary subscriptions (or renewals) are on the way to the readers listed below, who quickly responded to our invitation in the January editorial. If you missed out on that one, we hope you caught our second invitation, in a more-recent issue. If not, keep watching.

William H. Beam, Jr.
Terrence W. Beverly
Ray Caudell
Al Fierstein
Philip R. Gere
Bob Katz
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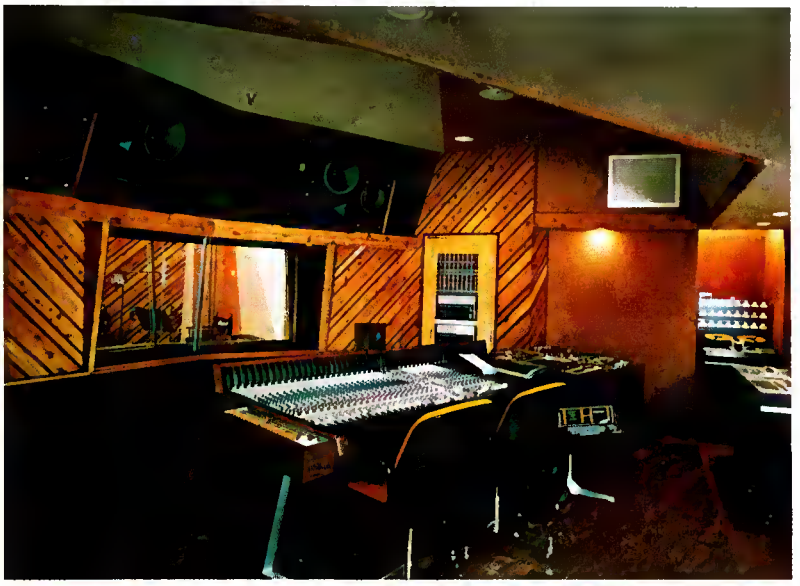
STUDER REVOX

JOHN WORAM

Recording Studio Design and Acoustics

The second national convention of the Society of Professional Audio Recording Studios brought together a prominent group of consultants whose opinions are as diverse as their individual designs. As surprise would have it, though, they do agree on ***some*** *things.*



The control room of Streetervlle Recording Studios, of Chicago, as designed by George Augspurger of Perception, Inc.

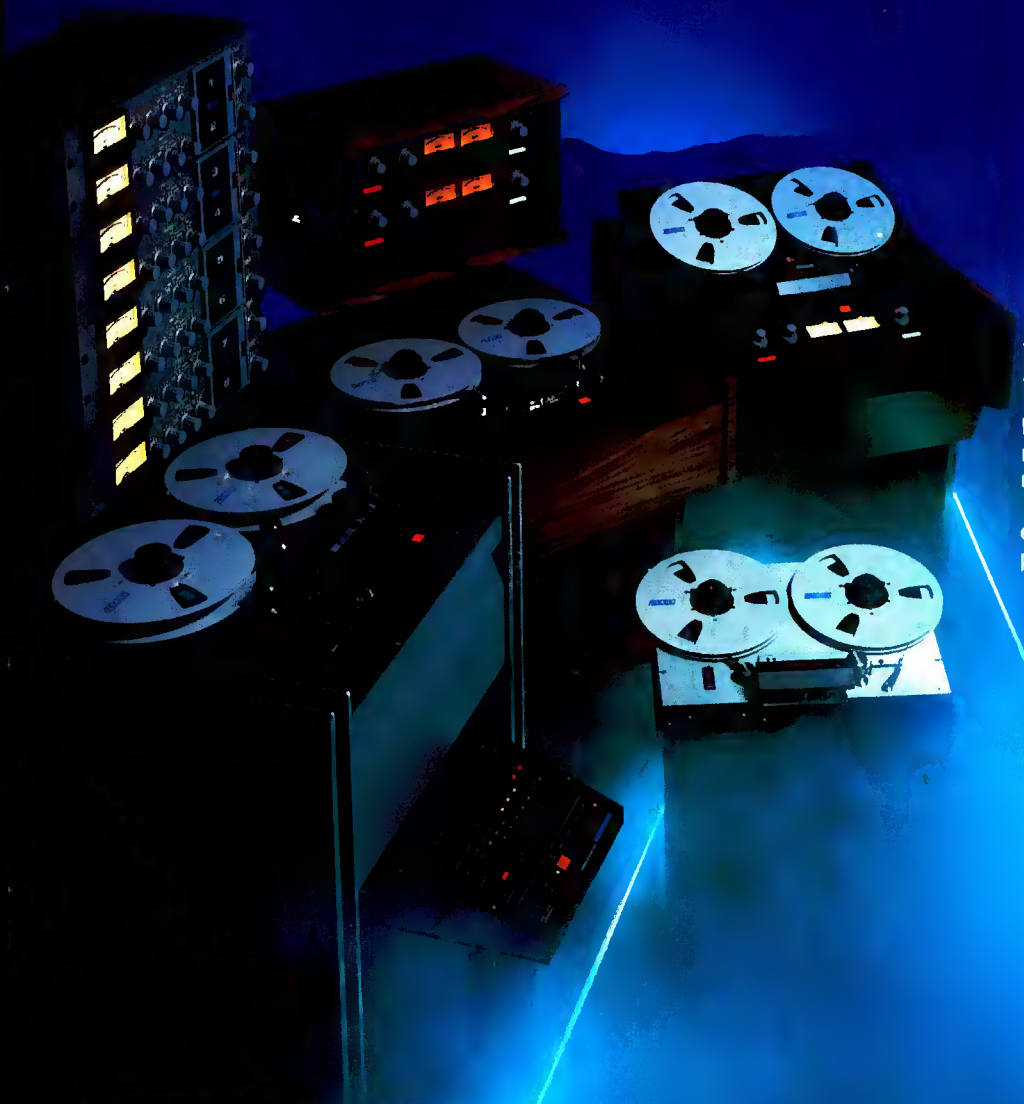
SPARS—THE SOCIETY OF PROFESSIONAL AUDIO RECORDING STUDIOS—recently held its second national convention (Los Angeles, May 3-7). In existence for less than one year, almost 40 recording studios are now found on the SPARS roster of member studios.

John Woram is the editor of db Magazine, principal of Woram Audio Associates, and author of the "Recording Studio Handbook."

During the SPARS gathering, one day was set aside for a series of seminars on various aspects of the recording industry. The seminar, Recording Studio Design and Acoustics, brought together a panel of prominent acoustical consultants, who discussed their various approaches to the subject.

In his introductory comments, SPARS v.p. Bob Liftin (Regent Sound, New York City) reminded seminar participants that—unlike the recording hardware within—the studio and control room can't be traded in easily, whenever a new model is introduced. Yet, acoustic design fashions certainly do change over the years, as several panelists noted. And, when a new

the New Workhorse



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Models 5050B & Mark II-4 shown in optional cabinets available from the Rus Lang Corporation, Bridgeport, Conn. (203) 384-1266

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concept in studio acoustics is proposed, it's almost impossible to day any "comparison shopping" before buying. The best you may do is listen to someone else's room, and then try to imagine what your studio might sound like, given a similar acoustic treatment. Worse yet, you can't exchange the finished product for a different model, if you don't like it once its completed. Of course, you can always tear down and re-build, but that gets rather expensive, as the folks at Lincoln Center can tell you.

All of this points up the need for lots of advance "homework" before undertaking any studio construction project. Many studio owners prefer to call in outside help, and to give SPARS members a better idea of what's available, each panelist presented his approach to studio acoustics. Summaries of each presentation are given below.

BRIAN CORNFIELD

Brian Cornfield recently completed a new studio for David Gates of Bread, and has developed an analysis of a 25,000 square-foot studio complex for the Osmonds in Provo, Utah. Other credits include the Music Annex in San Francisco, and post-production and tele-cine studios for Compact Video in Burbank. Currently under construction in Guatemala is a ground-up 24-track recording studio and disc-mastering facility.

Cornfield stresses the importance of more-effective use of space, particularly in wall treatment. With floor space at a premium, he prefers a 6-inch multi-band trapping system, rather than the 3- or 4-foot traps used in the past. Metal-stud wall construction helps, by offering some inherent low-frequency attenuation due to flexing, as well as satisfying most fire codes.

On the David Gates project, Cornfield developed a sandwich-type broad-band vari-trap system, using Owens Corning and US Gypsum aborptive materials. The surface of the trap is a large shutter system, which when closed gives a reflective characteristic to the room. Opening the shutters gives about 60 percent absorbency into the face of the trap. The trapping is not used near the drum booth, in order to prevent shutter rattling.

When possible, Cornfield designs his control rooms within a 25 x 25-foot shell, with a height of 9-to-10 feet. Side walls are usually non-reflective, backwards from the center position, and the ceiling and rear walls are soft. Speakers are placed at ear level and perpendicular to the floor. The engineer's seat is placed at four-to-six times the distance between the low- and high-frequency drivers. Console placement is determined by the speaker angle, which is typically 60-to-90 degrees.

The audience is at the rear of the control room, where there is usually an 8-to-10 foot sofa on a small riser (6-to-8 inches).

JOHN STORYK

John Storyk has a degree in architecure from Princeton, and his company, Sugarloaf View, was founded in 1974. Specializing in acoustical design and construction, his credits include Electric Lady in New York, Leon Russell's church in Tulsa, Record Plant's Studio B in Los Angeles, and studios in Jamaica, Trinidad, Iceland and Africa.

Storyk considers himself an architect, and not a studio hardware specialist. "I can't even turn most of it on," he quips, and confesses to really being a frustrated amateur musician. As for "pre-testing" a studio design, theoretically its possible, by faithfully duplicating an existing room. Practically though, Storyk finds that most clients want "different than," rather than "same as." And so, the acoustician/architect must come up with an original design almost every time, and of course, some mistakes will sometimes be made. Storyk recalls that Buckminster Fuller once said that if you ever meet a person who doesn't make mistakes, he's probably not doing anything.

To keep mistakes down, and cost overruns and other unpleasantness to a minimum, Storyk advocates a detailed pre-construction program. Before starting, many clients don't know precisely what they want. How big? How much? How many musicians? What kind of music? All these questions must be answered up front. If they're not, the program wasn't detailed enough, and there are bound to be mistakes.

As Storyk analyzes successful studios, he finds that many are not the glamour packages that appear on the covers of magazines. Yet, these studios are successful because they have correctly analyzed their own unique position in the marketplace. They evolved over the years, improving with age, and each one is the result of a successful program, and—each one is different.

Citing his own designs over the past six of seven years, he notes that there is no one "Storyk design"—they all look and feel different, due to client needs, budget, location, etc. Storyk described a studio built in Iceland, where lava was used throughout due to its accessibility, and the fact that there is little or no wood available on the island. The same construction technique would not go over too well in Africa. In other words, the program must also take into account the natural resources of the client's venue.

JEFF COOPER

Jeff Cooper studied architecture under Bob Newman of Bolt, Beranek and Newman, and did his thesis on recording studio design. His recent projects include a 3,000 square-foot studio for Polygram Records in Singapore, San Francisco's American Zoetrope Studios, and Fantasy Films. He has also designed three studios and two disc-mastering rooms for Velvet Records in Venezuela, and a sound research room for New York Institute of Technology in New York.

Cooper notes that his designs try to realize some undescribed goal which every client has when he begins. He doesn't endorse any specific style of room acoustics, such as near- or far-field monitoring, live end-dead end, etc. Instead, he tries to achieve the kind of "ideal" room that the client prefers. As a consequence, some Cooper rooms are very bright, while others are almost anechoic. Some are very large (a 30 x 30 room with an 8 x 17 window), while others are quite small (4 x 4!).

Over the last ten or more years, Cooper has seen studio design change to meet the isolation needs of multi-track recording. The old studios of RCA and others were built for diffuse ambience, and musicians liked to play music in them. Then came drum booths, piano traps, and isolation rooms. Recording engineers liked the separation, but musicians didn't like the "feel." The rooms were dead, and inflexible: the piano had to be in the trap, the drums in the booth, and so on.

About three or four years ago, the emphasis came back to bands, and to groups of musicians. Cooper's designs are now going back towards the style of the older rooms. He's designing for an overall room ambience, and then handling isolation on a "per-instrument" basis. Typically, this may be one continuous treatment, with diffuser slats pre-positioned at 45 degrees. Bass trapping is in the ceiling, with design details determined by membrane resonator formulas.

With tight floor spaces and costs, Cooper feels the best way to handle acoustical treatment is to fully utilize the ceiling—take the treatment away from the walls, so you don't use of valuable floor space. In fact, he includes ceiling height and cubic volume

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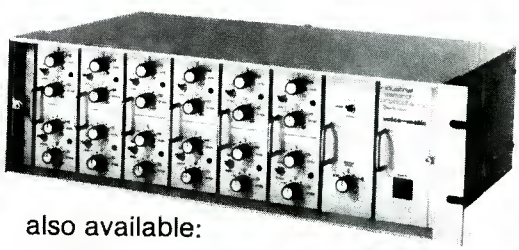

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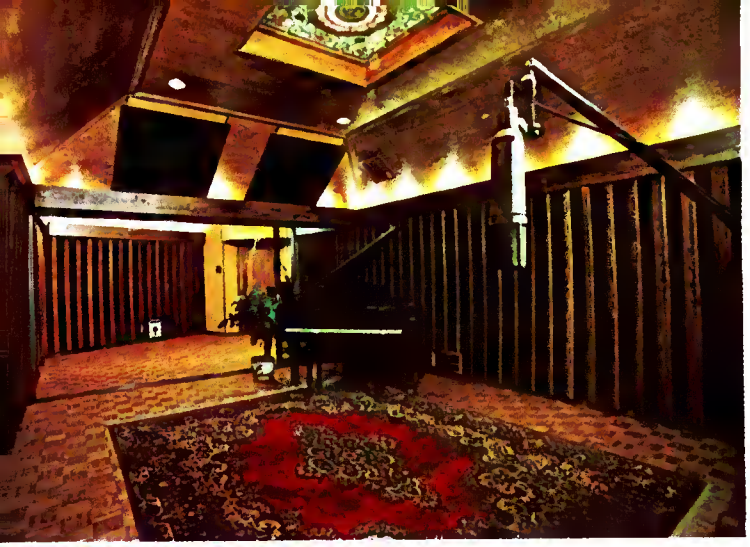


Golden Age Recorders in Culver City, California. This studio features a modular diffuser-slat design to optimize room ambience and increase reverberant field homogeneity. Bass absorption is accomplished by the ceiling resonator cove, and natural light provided by the four-paned acoustical skylight. Acoustic design by Jeff Cooper.

among the most important parameters in studio design. He's even gone to the point of excavation, in order to provide sufficiently high ceilings.

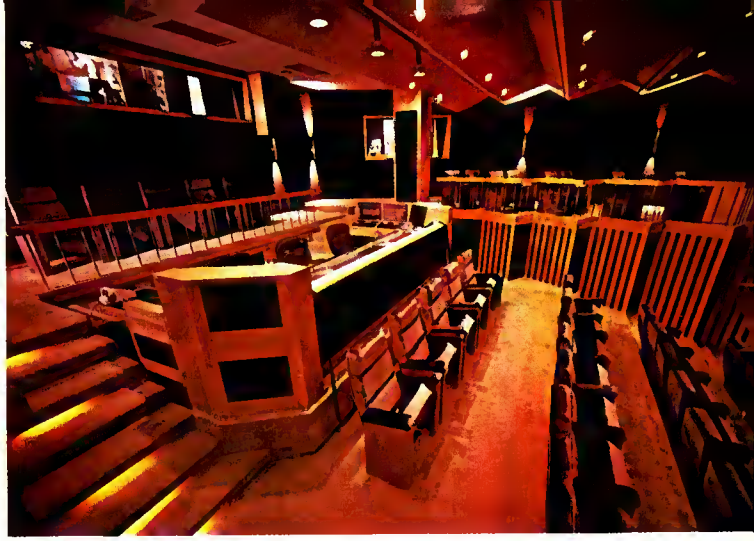
GEORGE AUGSPURGER

George Augspurger founded Perception, Inc. about ten years ago, and since that time has been active in architectural acoustics and large-scale sound system design.

Unlike the architect/acoustician and the turnkey studio supplier, Augspurger prefers to work in cooperation with an architect or studio supply house. He points out that there is no miracle set of rules for building a studio, and no single philosophy will please all of the clients all of the time. Homework is very important, and can save considerable time and money.

As studio design work evolves, Augspurger is sure that the services of many of the old theoretical acousticians, who lost some favor during the early days of multi-track, will be at a premium once again. These people still know how to design studios that are quiet, with extremely high transmission loss.

Pictured are the studio and isolation booths at Sound West Studios, San Diego, Ca., also designed by Augspurger. The design highlights modern decor in harmony with functional capability.



A side view of Fantasy Film's film mixing facility, Berkeley, Ca., as designed by Jeff Cooper. (See this month's cover for another view.)

Augspurger always factors room equalization into his control room designs, although he is quick to point out that the best equalization is usually also the least equalization. He states he's never heard a control room that couldn't be made a little better with the option of equalization, although this may be nothing more than trying to make the left speaker sound like the right speaker. Of course, room equalization should never be used as a bandage, to patch up a poorly designed room.

SUMMING UP

The panelists all seemed to agree that studios and control rooms should not be mass produced, as if they were microphones or loudspeakers. Although the room is also a transducer, its design needs to be tailored to meet the particular requirements of the client. And, as noted several times, the room cannot be replaced quite so easily as the other transducers.

For further information on studio design and acoustics, the panelists are;

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Perception, Inc.
Box 39536
Los Angeles, California 90039
(213) 933-5601

Brian Cornfield
Everything Audio
16055 Ventura Blvd.
Suite 1001
Encino, California 91436
(213) 995-4175

Jeff Cooper, consultant in acoustics
22627 Cavalier Street
Woodland Hills, California 91364
(213) 887-9100

John Storyk
Sugarloaf View, Inc.
31 Union Square West
New York, NY 10002
(212) 675-1166

For further details about SPARS, see the **db** Special Report in our October, 1979 issue, or write to;

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215 South Broad Street
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■

DON & CAROLYN DAVIS

Time, Energy, and Frequency Measurements for Sound Definition

Utilizing equipment already used by most acoustical consultants, TDS and ETC is an instrumentation system limited only by the wit of the user to apply it and interpret the results.

OVER TWENTY YEARS AGO (1957), one of the truly great audio investigators, William B. Snow (who gained early fame as a part of the Bell Telephone Laboratory scientists that did the first stereophonic demonstrations in 1931 and 1932), wrote an article entitled, *Application of Acoustical Engineering Principles to Home Music Rooms.* This article appeared in the 1957, Nov.-Dec. issue of the *IRE Transactions on Audio.* The article, almost totally unknown among high fidelity aficionados, is timeless in its approach to needed fundamentals. To quote,

The direct sound has an extremely important role.... It contributes to the appreciation of short transient sounds. But, more than that, it alone carries the information giving the sense of direction, by allowing the listener to observe initial transients clearly during the short time interval before the many directioned reflections begin to arrive at his ears.

Reverberation is both good and bad.... Reverberation raises the sound level and adds a quality to music which people enjoy, in addition to helping musicians play by allowing them to hear themselves and each other. But if it is excessive, it destroys definition.... As in the case of so many engineering problems proper control must be exercised to gain the benefits while minimizing the detrimental aspects.

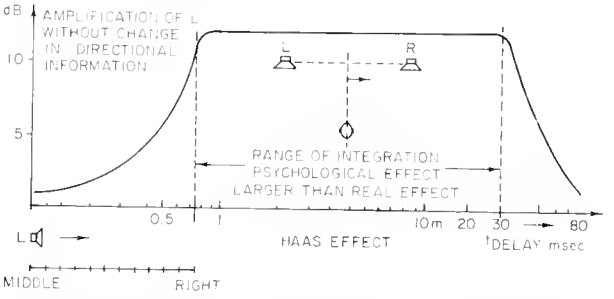
Further on in discussing room resonances, he writes:

As soon as there are reflections at the room boundaries, this effect (resonance) will persist and there will be differences in response at various parts of the room. It should not be considered a fault—people like to listen to music in rooms, and this is a normal characteristic of that kind of listening. As with reverberation, the proper procedure is to control the effect and this is done primarily with room shape.

THE HAAS (PRECEDENCE, HENRY, FAY-HALL, ET AL) EFFECT

E. Madsen's paper, *The Disclosure of Hidden Information in Sound Recording,* includes an excellent visualization of the so-called Haas Effect parameters. (For the purposes of this article, what the authors mean by the Haas Effect is the psychoacoustic fusion of common origin signals from spatially separated sources into an apparent single image located at the position of the nearest—in time—source.)

Figure 1. The "fusion zone for a common origin signals where one source is delayed in time varies over the time region shown by Madsen (for a single reflection). The effect is dependent upon the reverberation time of the acoustic enclosure and can vary from less than 1 msec in an anechoic chamber to over 30 msec in a very "live" room.

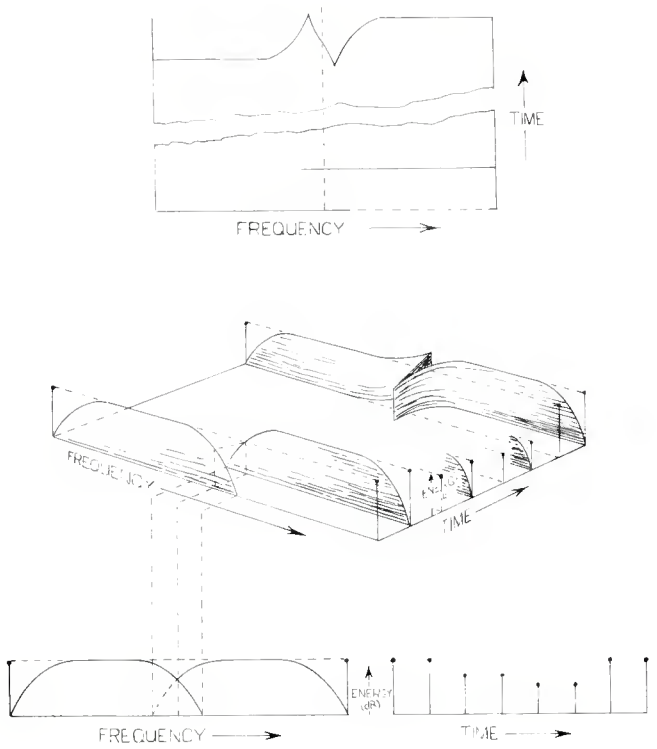


If a person sitting symmetrically between two identical noise sources L and R receive exactly the same sound impulse from both sources, it appears to him that there is only one sound source midway between L and R.

But if the pulse L is increasingly delayed with respect to R, the sound picture moves quickly over to R, where it stays until the time delay goes over a certain value. Beyond this one hears two separate sound impulses. These conditions do not change, even if the source L is made louder than source R. It is only when the volume ratio exceeds values in the curve shown, that one recognizes L as a separate sound source.

The apparent volume of the sound source is subjectively felt to be greater than the actual volume of the source.

Don & Carolyn Davis are freelance writers who have authored many articles on a variety of audio-related topics.



Three views of the monitoring environment.
Lower left: This front view shows the familiar "frequency response." The fact that high frequencies are delayed is not apparent.
Lower right: In this side view, we see energy-versus-time.
Top: In examining frequency-versus-time, we may observe the "time smear" in the vicinity of the crossover region. This irregularity will vary from one system to another.
Center: A three-dimensional representation of time, energy and frequency responses.

This psychoacoustic fusion, first recognized by Joseph Henry over 125 years ago, is today normally identified as either the Haas Effect or the Precedence Effect. FIGURE 1 illustrates the parameters governing this effect according to Madsen.

An excellent overview of this subject is Mark B. Gardner's *Some Single—and Multiple-Source Localization Effects* that appeared in the *Journal of the Audio Engineering Society,* July-August 1973, Vol 21, No. 6, pp 430-437. This paper is accurate, succinct, and accessible. Its bibliography is extensive and well chosen.

Recently in a letter to the Editor of the *Acoustical Society of America* entitled, *Effects of Early Multiple Reflections on Subjective Preference Judgments of Music Sound Fields,* Y. Ando and D. Gottlob point out their conclusions, *The delay time of the first reflection is not as important as the delay time of the strongest reflection, Journal of the Acoustical Society of America,* Vol. 65(2), Feb. 1979, pp. 524-527.

Even more fundamental is the earlier work of Heinrich Kuttruff in his book, *Room Acoustics* (Applied Science Publishers, London 1973) in which he notes that, *"If there is a hot, hard reflection within the first 20 msec, the masked shadow zone (fusion zone) will be extended beyond the 20 msec value."* (The authors are indebted to the Boston acoustical consultant, Ted Uzzle, for bringing this information to our attention.)

Carefully-generated reflections could extend the fusion zone to as much as 50 msec. The work of Leo Beranek in his book, *Music Acoustics and Architecture,* points out the importance of the initial time delay gap to the subjective aural judgement of a room's size. While there is debate regarding other claims made for various initial time delay gaps, there is no debate regarding its role in judging the apparent size of a space.

Finally, the work of the authors in the development of the "live end-dead end" (LEDE) control room results in an orderly understanding of the architectural acoustic requirements of a small room.

In the evaluation of any monitoring system and/or environment, we are accustomed to examining frequency and amplitude. For example, FIGURE 1 (lower left) illustrates the energy-versus-frequency of a woofer and a tweeter, plotted in the conventional form which we have been taught to call a "frequency response."

To the right of the frequency response, we see a plot of energy density-versus-time, which we call an ETC curve. It will soon become apparent that ETC is by far the most-useful viewpoint, whenever a sound source is placed in a room.

If we consider TDS and ETC as front- and side-views of a three-dimensional drawing, we discover yet another way to look at the variables: from the top, we may observe a frequency-versus-time curve, or FTC. This is shown at the top of FIGURE 2. To summarize, we have:

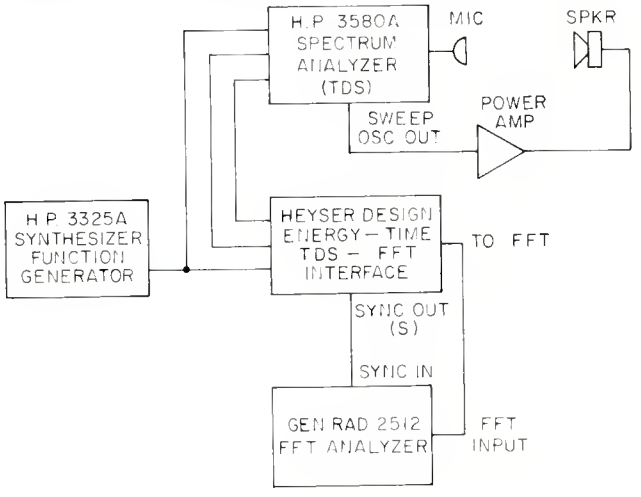
TDS—amplitude-versus-frequency response.
ETC—an energy-versus-time response.
FTC—frequency-versus-time responses.

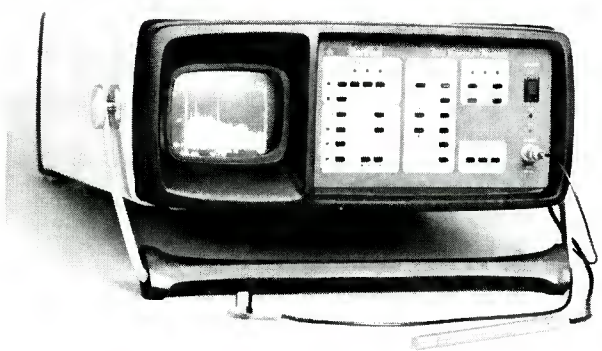
TEF MEASUREMENTS

TEF is a combination of the time, energy and frequency responses, as seen in the three-dimensional representation at the center of FIGURE 2. This TEF combination can give unbelievable insights into the interface of electro-acoustic sources with architectural spaces. (For another type of three-dimensional analysis, see Three-dimensional Analysis: It's About Space, in the April 1979 issue of **db**—Ed.)

TEF is the brainchild of mathematician-philosopher Richard C. Heyser. The real significance of TEF is the spreading realization that here is a new acoustical and electrical measuring system with literally a hundred techniques superior to those currently in use. TEF also speeds up acoustical measuring work in architectural spaces by a factor of 10,000-to-1, and the ETC technique should prove to be particularly useful.

Figure 3. The Heyser module is an inverse Fourier transform from frequency back to time with both amplitude and phase accounted for as energy density.





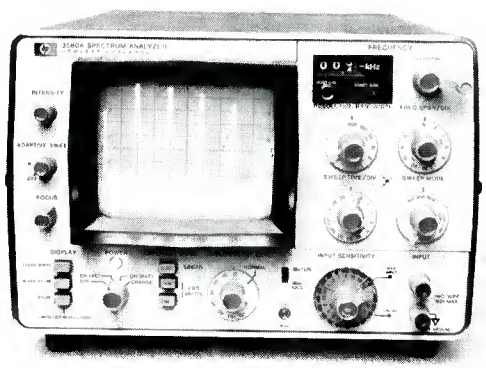
The GenRad model 2512 spectrum analyzer.

Frequency Range: DC-10 Hz to DC-100 kHz in a 1-2-5 sequence.

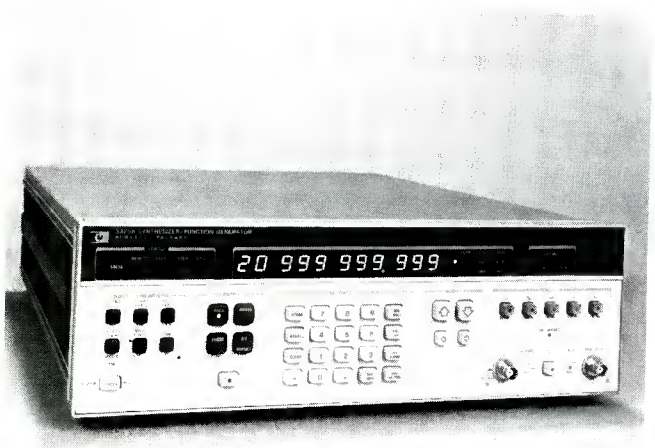
Analysis Bandwidth Hz	Frequency Resolution Hz	Time Window Sec
10	.025	40
20	.05	20
50	.125	8
100	.25	4
200	.5	2
500	1.25	.8
1000	2.5	.4
2000	5	.2
5000	12.5	.08
10000	25	.04
20000	50	.02
50000	125	.008
100000	250	.004

Resolution: 400 lines of frequency resolution.

Figure 4. Chart of GenRad readout contrasting analysis bandwidth, frequency resolution, and time window.



The Hewlett-Packard 3580A spectrum analyzer.



The Model 3325A synthesizer and function generator from Hewlett-Packard.

Some of the equipment used by the author for the analysis described in Figure 3.

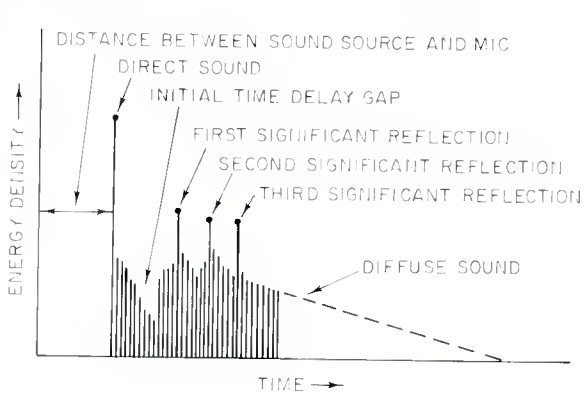
USING THE ETC TECHNIQUE

Readers of the Journal of the Audio Engineering Society are familiar with Dick Heyser's use of ETC in the testing of loudspeaker systems. The extension of his technique to include the reflecting surfaces in a room is inherent in Dick's patented process.

Before going into the analysis of specific data, let's first briefly describe how we are making the measurements and some of the equipment that is used. FIGURE 3 shows the interconnection of the specially-modified FFT analyzer we use with Heyser's inverse FFT circuitry. (FFT stands for Fast Fourier Transform.)

A Hewlett-Packard Model 3325A frequency synthesizer/function generator is used because its stability allows repeatable measurements separated by a lengthy period of time. The particular FFT analyzer we prefer is the GenRad 2512 spectrum analyzer. This is a narrow-band, 400-line analyzer, distinguished by its ease of setup and controllability. Instead of myriad knobs and switches, it displays "menus" on its screen, and you select—with a movable cursor—the functions you desire. As each menu page is called up, any material made non-selectable by a previous selection is deleted, leaving only those choices that are still viable. We literally set up our first 2512 without an instruction manual, and had a good workable measurement going in about two minutes.

Figure 5. This shows a theoretical depiction of a desired sound field in a sound reproducing environment such as a home music room or a recording studio control room.



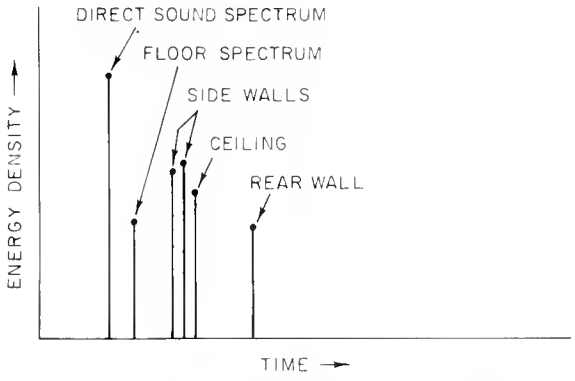


Figure 6A. How ETC data is interpreted. In this example we have marked out the direct sound plus the floor, ceiling, and rear wall reflections.

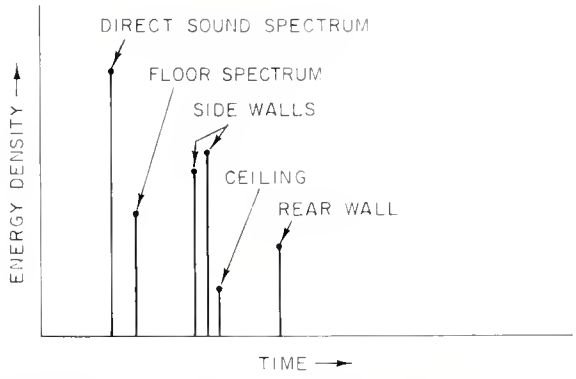


Figure 6B. By holding a hand over the microphone, the display changes to this form.

The equipment works in the following manner: We adjust the TDS signal analyzer's sweep rate for 10 kHz-per-second, and a linear amplitude mode is selected. The resolution bandwidth of the internal filter is set to 300 Hz.

On the GenRad FFT analyzer, the nearest corresponding time scale of 0.8 seconds shows a bandwidth of 500 Hz (see FIGURE 4). Using a proprietary Heyser module, the 500 Hz frequency scale on the FFT becomes a 50 msec time scale (500 Hz/10 kHz-per-second = 50 msec). Since there are 400 lines of resolution on the FFT, the time-per-line is 50 msec/400 lines, or 0.125 msec-per-line. This corresponds to the former frequency-per-line resolution of 500 Hz/400 lines, or 1.25 Hz-per-line.

The FFT analyzer now displays an ETC curve, such as the one seen in FIGURE 5, although the analyzer's cursor continues to provide a "frequency" readout which of course now had no direct significance. However, if the cursor is moved directly into alignment with one of the displayed lines, we may calculate the distance (from the microphone) from which that particular displayed ETC spectrum arrived, by the formula;

$$\text{distance} = \text{time per line} \left[\frac{\text{FFT frequency}}{\text{freq-per-line}} \right] \text{velocity of sound}$$

Thus, if our cursor readout displayed say, 78.5 Hz, the distance would be;

$$0.000125 \left[\frac{78.5}{1.25} \right] 1130 = 8.87 \text{ feet}$$

The next formula calculates the time it takes to travel that distance;

$$\left[\frac{78.5 \text{ Hz}}{1.25 \text{ Hz-per-line}} \right] 0.125 \text{ msec-per-line} = 7.85 \text{ msec}$$

It is easy to see that by placing the FFT's cursor on the desired reflection, its total travel time and distance are readily available.

THE IDEAL ETC RESPONSE

What kind of ETC signal should arrive at a listener's ears? From the above information, the desired criteria can be listed. These criteria are also seen in FIGURE 5.

1. An initial time delay gap of 15 to 20 msec. The initial time delay gap is the time in msec between the arrival of the direct sound and the first reflection of significant level.
2. A second hot reflection within 15 to 20 msec after the first significant reflection.
3. Diffusion of the reflections.
4. Control of the number of higher-energy reflections.
5. No premature high-energy reflections that cause broadband anomolies.

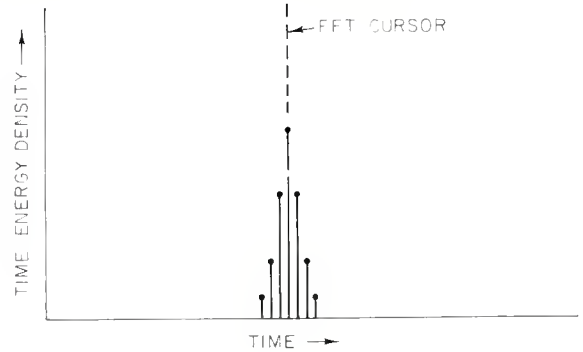
FINDING THE DIRECTION OF ARRIVAL FOR EACH REFLECTION

While knowing the total energy density of each spectrum and its time of arrival or total travel distance is helpful, the "real time" ability to tell its direction of arrival makes ETC a revolutionary tool for studying and correcting room geometry and absorption.

For example, suppose that we observed an ETC display such as FIGURE 6A. If, when we place our hand between the microphone and the ceiling the ETC changes to FIGURE 6B, we know which spectra came from the direction of the ceiling by noting the attentuated spectra on the second display. Their arrival time tells us if they are first, second, or later reflections.

By placing the FFT cursor directly on the line identified as the ceiling spectrum, we can then "tune" our TDS frequency offset and observe it on the FFT screen by going to the 10 Hz bandwidth on the TDS analyzer. When the TDS offset is tuned precisely to the cursor, a display such as FIGURE 7 appears. If at this point we punch from linear to log mode on the TDS amplitude mode, we see displayed on the screen of the TDS analyzer the energy-versus-frequency (i.e., the frequency response) of the ceiling reflections. Since all this is occurring as fast as the TDS analyzer is sweeping (essentially, a real-time observation), it is possible to actually watch the effect of placing absorption on the surface, changing the surface's angle,

Figure 7. This is what the FFT screen looks like when not allowed to see the full 50 msec of time (this is accomplished by narrowing the bandwidth of the sweeping band pass filter in the TDS analyzer.) This mode allows precise "tuning" of the TDS offset oscillator to the FFT's cursor (set on a selected reflection spectrum) directly with speed and accuracy.



placing a diffuser on the surface, etc. (See FIGURE 8.) The observation can take place either as a frequency response, or as an energy-time (ETC) response.

MEASURING THE VELOCITY OF SOUND

An interesting aside is that this technique can be utilized to measure the velocity of sound, even when you are not sure where the actual acoustic center is located. Make two measurements, at say, 4 and 16 feet. Note both FFT displays. The difference between the two readings is absolute, with reference to your measured distance.

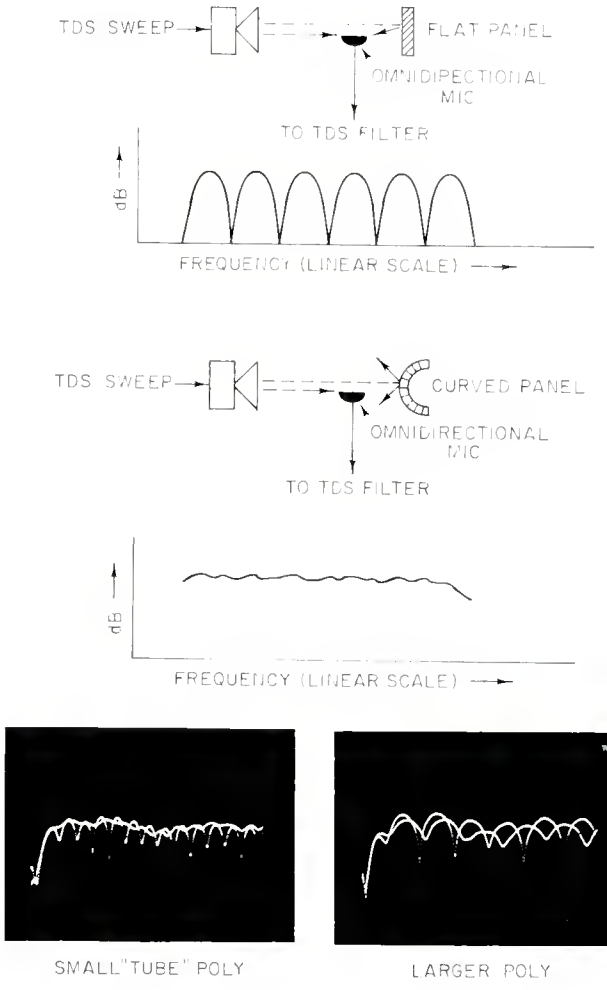
$$\text{velocity of sound} = \frac{\text{measured distance} \times \text{frequency-per-line}}{\text{time-per-line} \times \text{difference between FFT displays}}$$

As an example, suppose that we find that at 4 feet, the FFT reads 35.4 Hz and at 16 feet it reads 141.6 Hz. Therefore, the velocity of sound is;

$$\frac{(16.4 \text{ feet})\ (1.25 \text{ Hz-per-line})}{(0.000125 \text{ sec-per-line})\ (141.6 \text{ Hz} - 35.4 \text{ Hz})} = 1129.4 \text{ feet-per-sec}$$

This measurement is valuable in doing your regular TDS measurements where the velocity of sound acts as a constant in your distance calculation. (See FIGURE 9.)

Figure 8. Having "tuned" to a reflection spectrum, the TDS view can be used to adjust diffusion or absorption.



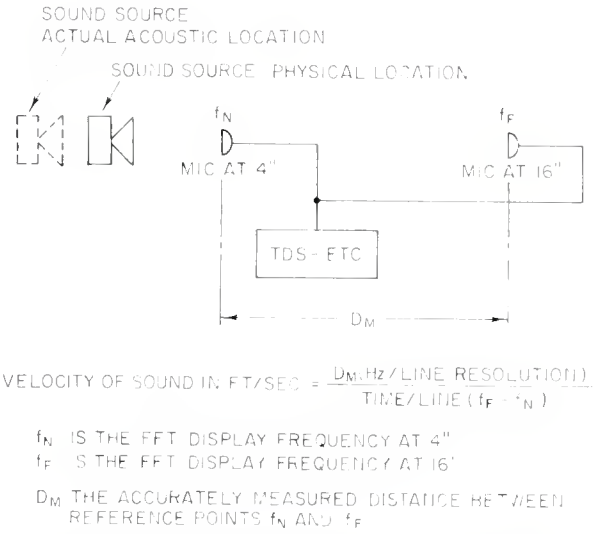


Figure 9. The measurement of sound velocity can serve as a useful familiarization exercise in ETC techniques.

SUMMARY

TDS-ETC means that we can literally adjust the initial time delay gaps, spacing of early hot gap reflections (a la Kuttruff Ando, Gottlob) while insuring good diffusion. When a boundary returns too much or too little energy, either too early or too late, we can identify the offending surface quickly, and observe the change as we treat it. We are able to show the role of reflections in the construction of what are called room modes, and demonstrate how to influence their development.

Obvious uses of TDS-ETC are;

1. Observe the time correction of loudspeakers, loudspeaker arrays, and see "time warp."
2. Observe ETC during sound system feedback, to detect precisely which surface or surfaces interact with the sound source to cause the particular feedback being heard.
3. Measuring the velocity of sound.
4. Observe the adjustment of digital time delay devices.
5. Observe the effects on an electrical signal as it passes through a typical console's processing.
6. Calibrating psychoacoustic experiments relative to variations of time, energy, frequency, etc.
7. Measuring the distance to an inaccessible surface by reflecting sound from it.
8. Observe the changes in velocity that occur when sound passes through differing material, such as wood, glass, air, water, etc.
9. Determine with great accuracy the direction of arrival and the distance traveled.
10. The measurement and observation of direct, reflected and total sound energy vs. frequency.
11. The measurement of loudspeaker directivity factor by a single sweep of the TDS analyzer.
12. Absorption and reflection coefficients in situ as they are applied and adjusted.

Truly TDS-ETC is an instrumentation system limited only by the wit of the user to apply it and interpret the results. Utilizing equipment already used by competent acoustical consultants (wave analyzer, FFT analyzer, frequency synthesizer, counter and voltmeter) in addition to the usual and still required 1/3 octave analyzer, TDS-ETC growth is primarily limited by the user's need of application training.

The next important step in the development of the TDS-ETC system of measurement is the manufacture of a dedicated instrument designed specifically for electro and architectural acoustic applications at a price accessible to the professional audio engineer and serious experimenter. ■

MICHAEL RETTINGER

A Live-End Environment for Control Room Loudspeakers

Recent studio design trends have attempted to make the control room area more sound absorbent. This analysis discusses the advantages of a ***reflective*** *environment about the loudspeakers in control room applications.*

ATTEMPTS HAVE BEEN MADE to introduce sound absorption in the vicinity of the control room loudspeaker (l). This has been done to minimize acoustic comb filter effects when first-order reflections about the radiators meet with the direct sound wave at the mixing console. It is the purpose of this analysis to discuss the advantages of a *reflective* environment about the loudspeakers in a control room.

TESTING FOR INTERFERENCE

Interference produced by a single reflection and a direct sound ray can readily be depicted graphically, and a real-time analyzer can also demonstrate this phenomenon in the open when a single microphone is employed. It is more difficult to calculate the quantitative effect, and to evaluate the qualitative effect, of more than one first-order reflection arriving at the listener's head. A dummy head with a high-quality condenser microphone in each ear, a phase-correcting network for the transducers, rectification of each microphone before mixing for an average effect, and adequate filtering will result in a loudspeaker response curve somewhat different from that contained for the single receiver in the open with only one microphone. When loudspeakers are tested with several like signals, the response irregularities depend on the distance between the transducers, the time intervals between them and their phase relationships. The difficult part of the experiment, however, is to evaluate the qualitative results on music, with its highly-transitory signals, when such first-order reflection interference takes place in an enclosure such as a control room.

ACOUSTIC COMB FILTER EFFECTS

The shorter the time intervals between the individual reflections and the direct sound, the less is the ear able to detect acoustic comb filter effects. Also, such reinforced music is often evaluated as "more pleasing," simply because of this variety of phase effects. By the same token, the music of many violins in a symphony orchestra is preferred over that of but a few such string instruments, even though there exists a wide variety of phase relationships between the many violins. And, what mixer has not noticed the unpleasant reverberatoriness resulting from a "one-dimensional" reverberator like a spring compared to the pleasing impression achieved with a "three-dimensional" unit like a chamber when "reverb" is added to a program?

DIAMETER-TO-WAVELENGTH RATIOS

FIGURE 1 shows the directional characteristics of a vibrating piston in an infinite baffle, for various ratios of piston diameter-to-wavelength (D/λ). For such a device, we may write the formula,

$$R = \frac{J_1(x)}{kD/4 \sin \lambda}$$

R = response, at angle, a.
$J_1(x)$ = a Bessel function of the first order (see text).
D = diameter of piston.
k = $6.28/\lambda$
a = angle of radiation.
λ = wavelength of sound.

Although Bessel functions are complex, they need not be mysterious, or beyond the reach of the studio designer: there are tables available for this mathematical relationship, even as there are tables for sine, cosine, tangent, etc. For example, in the function, $J_1(x)$, when a = 90 degrees and f = 200 Hz, then x = 0.5kD sin a, or 0.4081. From a Bessel function table, we find that $J_1(x) = 0.1960$. With this value in the numerator of the formula given above, we find that the speaker response at 90 degrees is 0.96.

LOUDSPEAKER POSITIONING

Now, to further explain, and illustrate the undesirable effect of placing a loudspeaker above a large window in an otherwise-

Michael Rettinger is a consultant on acoustics and author of "Acoustic Design."

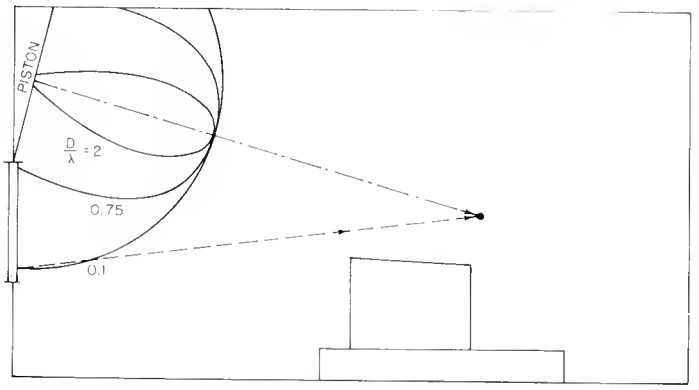


Figure 1. Directional radiation characteristics of a circular piston in an infinite baffle for various ratios of piston diameter to wavelength of generated sound.

absorbent front wall of a control room, let's examine a practical application. Consider a woofer with a 1.5 foot diameter diaphragm, emitting a 100 Hz tone. (When the parameter d/λ is multiplied by the speed of sound, we obtain the frequency of the signal being radiated by the piston.) For such a unit, the directional output is practically a hemisphere, since we found that, at 90 degrees the response is 0.96, or 96 per cent of the output along the longitudinal, or normal, direction. This means that almost as much sound is directed at the control room window as is directed to the mixer. As shown by the dashed line in FIGURE 1, a strong first-order 100-Hz reflection is received by the mixer. When the environment about the loudspeaker is rendered highly sound-absorbent, this arrives without any accompanying first-order mid-range or treble reflections. This results in an amplitude distortion of the signal, not unlike that produced by raising the low-frequency response of the reproduce amplifier. Very likely, the mixer in such a situation will be tempted to attenuate the bass notes of his program, to the disadvantage of the final listener in his living room or den.

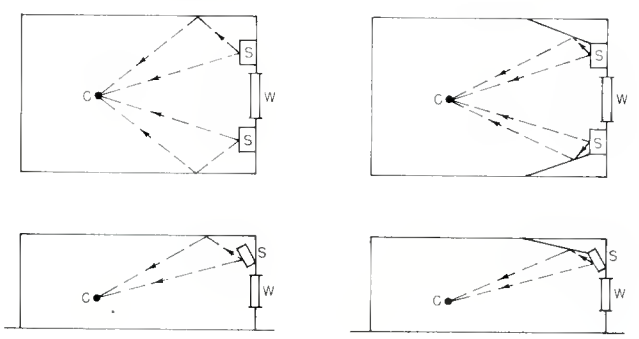
MINIMIZING EXCESSIVE TIME INTERVALS

To minimize excessive time intervals between the direct sound and first-order reflections arriving at the mixing console, reflective panels should be placed about the loudspeakers in a control room, as illustrated in FIGURE 2, chiefly for the high notes. There is presently no way to make a window sound-absorptive to reduce the time lag of the first-order bass reflections discussed above.

Besides the qualitative disadvantages connected with an absorbent environment about the control room loudspeakers, there are also other objections to such a configuration. Since it would obviously not be desirable to have both a dead front wall in front of the mixer and a dead rear wall behind him, we now require a live surface behind the console. But this leads to other problems, particularly in respect to the shape of this reflective rear surface. To prevent echoes, it has to be deeply corrugated so that the low-frequencies will be adequately dispersed instead of resulting in a standing wave phenomenon. And it may lead to longer time intervals between the first reflection from that wall and the direct sound, because of the distances involved between console and wall.

When a loudspeaker operates in the open or in an absorptive environment about itself, an acoustic impedance mismatch results between the unit and the air. When reflective surfaces are near the radiator—particularly when the unit is placed at the throat of a horn—this hard environment acts as an acoustic transformer to achieve a higher power conversion efficiency for the system.

Figure 2. The plan and elevation of the control room shown on the left side of the figure illustrate the relatively long time intervals between first-order reflections when the walls and ceiling of the room are utilized as reflectors; those on the right show the resulting short time intervals when reflectors are placed about the loudspeakers. C: console; S: speaker; W: wall.



"ONE MAN'S MEAT..."

This is certainly not to say that persons may not prefer such an acoustically-inverted control room. Does everyone like rock-and-roll music rather than Beethoven's Seventh Symphony or Wagner's overture to Tannhauser? And what about the many different musical scales from the scale of just intonation to the chromatic scale of equal temperament? Does every one like the same scale? NO! Similarly, some will prefer the reflective surfaces described in this article. Others will choose an absorptive treatment. In either case, there is no disputing personal taste.

REFERENCES

1. Chips Davis and Don Davis "LEDE Live End-Dead End Control Room Acoustics," *Recording Engineer/Producer*, February 1979, V. 10, No. 1. ■

JOHN ROLLO

Indian Creek Recording Studio: State-of-the-art, Texas Style

Nestled in the hills of Southwest Texas, Indian Creek Recording offers the best of recording technology in unique surroundings.

Indian Creek Recording Studio set in the rolling hills of Southwest Texas.

THE CONCEPT OF STARTING a 24-track state-of-the-art studio in the middle of the Texas hill country is in itself a unique idea. The project began three years ago by Marty Manry, President of Indian Creek Recording studio. The studio is located on a 4,000 acre ranch 80 miles west of San Antonio, Texas. As Southwest Texas enjoys near-perfect weather all year round, the location is ideal. Visitors to Indian Creek can also take advantage of the beautiful Texas hill country and surrounding rivers. Within a short distance is the Texas Gulf Coast and Mexican border.

John Rollo is Chief Engineer at Indian Creek Recording Studio.

A LARGE UNDERTAKING

Indian Creek Recording took nearly six months to design and detail, and another fourteen months to build. Its shear massiveness is unlike any other studio in the U.S., and it is unlikely that many will ever rival it. Constructed on the side of a gently-sloping hill, the foundation of the building has been set on bedrock, requiring slab beams as much as six feet in depth, while five different slab levels have been incorporated for visual, structural and acoustic purposes. The slab may seem a little overdone, but considering that all walls, exterior and interior, have been constructed of eighteen-inch-thick reinforced rock as high as eighteen feet, the reasoning becomes ap-

parent. The rock walls are integrated with nearly two thousand square feet of glass, producing a massive yet open look to the studio, control room and offices. A twenty-five foot diameter reception area, with fireplace, overlooks the countryside while its rear wall looks between one foot thick cypress support beams into the control room and on into the studio. Monitors are provided in the reception room to allow clients to both hear and see what is going on without interfering in the operation of the studio.

Acoustics have benefitted greatly through the high-density, non-resonant construction. The abscence of appreciable energy absorption due to the density results in a more uniform low frequency characteristic, or a more "present" low end, and correspondingly higher L/F isolation between adjacent rooms. The "solid" L/F nature of the room audibly enhances the natural response of instruments by eliminating L/F loss due to diaphramatic action of the room boundaries. To preclude resonances in the rooms, the construction is asymetric in the studio while the control room and studio utilize equal dimensional ratios to maintain similar acoustic character.

A stable recording environment has been created by the use of constant humidity/constant temperature air conditioning systems (three in all) so that multitrack sessions can continue over lengthy periods of time without changes in sound due to variations in outside climate.

INSIDE THE STUDIO

The studio is another conglomeration of fine woods, rock and glass. The piano bay is designed with a "soft" acoustic quality, using solid mahogany for the walls and sloping ceiling. In addition, a drum booth and two isolation booths are provided, one being 12 x 15 feet. The smaller of the two booths is quite live, while the larger of the two has acoustics which can be varied to suit the particular requirements of the engineer. The central section of the studio has a ceiling height of fourteen feet, below which are suspended clouds constructed of mahogany, oak and maple. The clouds are double sided with one side being hardwood while the other is treated for MF/HF absorbency. Again, the intent has been to provide an acoustic environment which can be tailored to suit the needs of the engineer/producer.

THE CONTROL ROOM

The final touch is the control room. At first glance it seems to be rather small. This is purely by design to optimize the near/far field relationship at the console, and because of the location of support equipment, it need not be cavernous. The recorders and electronics are located in the front quarter sections of the room, enclosed by smoked glass doors, well within view of the engineer but enclosed to eliminate any effect on room acoustics, noise and undesirable visual impact.

Abadon/Sun, Inc. (San Antonio, Texas), in designing Indian Creek with this degree of versatility, has incorporated the very live characteristic common in Europe and England with the "tight" controlled character of the American studios. Even the hallways have microphone inputs, making the building one huge, multifaceted studio.

Currently, recorders consist of an Ampex MM-1200-24 (being replaced Sept. '80 by an ATR-124), one Ampex two-track ATR-102 and one 30 ips ½-inch two track mastering ATR-102. Dolby noise reduction will also be available. Monitoring is provided through an array of three UREI 813 Time-align Monitors, arranged in a 105-degree arc to provide unusually wide stereo imaging without any "holes" in the image. Equalization is provided by White one-sixth and one-third octave equalizers to create a "house" effect. We strongly felt

The reception area featuring circular fireplace, an open view of the studio area, and monitors for listening pleasure.

that Neve offered the best console for our application in performance, reliability and minimal acoustic impact on the control room. You see, in this control room the only exposed "gear" to effect room acoustics is the console and engineer, so the shape of the console becomes a major consideration. (Actually, it always should be a major consideration, but the effects of equipment placement usually are more critical and more easily controlled so other designs tend to ignore console shape as being "something to live with.") Reverb for the studio is provided by Lexicon Digital units backed up with every imaginable special effects and signal processing device.

Indian Creek Recording represents a two-year design/construction effort which we feel has resulted in a truly unique recording environment of incomparable quality.

The Model 8058 Console from Rupert Neve, Inc., the choice of Indian Creek Recording.
An inside view of the spacious studio at Indian Creek Recording.

FROM ACROSS THE ATLANTIC...

To further the uniqueness of the studio, we have recruited John Rollo from England, to be our Chief Engineer. In his ten years of experience he has worked with many major recording artists including Eric Clapton, Cleo Laine, George Martin, Jack Bruce, Leslie McKeown, Annette Peacock, Max Middleton and Dave Davies. For the past two years he has worked for the Kinks at their Konk Studios in London. He was also the first and second recipient in England of the Ampex Golden Reel awards.

TOP QUALITY AT THE BEST PRICE

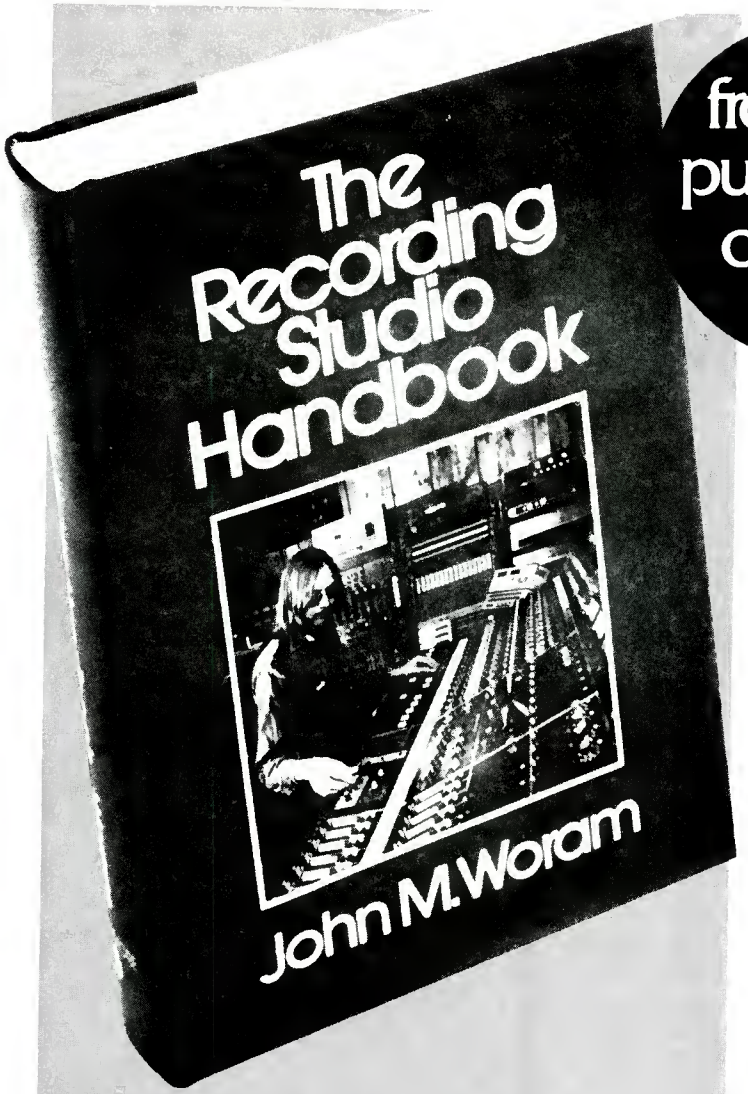
Everyone today is affected by the change in our economy, yet in spite of this, we feel we can offer a very economical recording facility. This is reflected in the studio rates of $200.00 per hour (discounts on block bookings), and $150.00 per month to house our clients. The fact that we are not making any kind of profit on housing again indicates our determination to offer a first class studio complex usually found only in major cities, but with a peaceful atmosphere and a "home away from home" feel.

We feel that Indian Creek offers the best of Los Angeles and London, but with a full helping of Texas hospitality.

For more information about recording or construction, **Texas-style**, contact:

Indian Creek Recording
911 Cherry Street
Uvalde, Texas 78801
(512) 278-5802

Abandon/Sun, Inc.
P.O. Box 6520
San Antonio, Texas 78209
(512) 824-8781



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- **Studio Noise Reduction Systems**
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- **The Recording Session**
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by John Woram

SAGAMORE PUBLISHING COMPANY, INC.
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JOHN BORWICK

Made in Britain

Presenting a quick guide to British professional equipment manufacturers.

ALTHOUGH IT IS ONLY A SMALL OFF-SHORE ISLAND, Great Britain has always made a sizable contribution to sound recording and broadcasting. On the creative side, we think of artists from Beecham to the Beatles, the great London orchestras, record producers like John Culshaw and George Martin, and the prestigeous output of the British Broadcasting Corporation. All this creative activity has spawned a large recording industry so that, despite the recent world recession and the regrouping taking place amongst major record companies, our trade organisation (The Association of Professional Recording Studios) now has more than 150 listed member studios. (For more about APRS, see the accompanying box—Ed.)

In support of the music-makers is a dedicated and inventive hardware industry. British studio engineers can shop for most of their requirements amongst home-grown products—particularly in the matter of mixing consoles and loudspeakers. As a result, sometimes because of the stories taken home by visiting producers from the USA and elsewhere who've worked on albums in London, British professional recording equipment now makes considerable exports to all corners of the world, and has built up an enviable reputation for good design and reliability.

To present an overview of the British manufacturing industry, I have given summerized listings of some of the better-known companies—rather than write longer essays about just a few, or in-depth descriptions of individual products. The listings show the main product lines manufactured, with an example unit and UK price to help identification of the companies' product image. Readers who want to follow up an interest in particular brands can approach the UK or US contacts shown. An even better idea is to visit the plants, or seek out the representatives at an exhibition. Practically all the companies listed here were showing at the 65th AES Convention in London in March, and will be on show at the 13th Annual International Exhibition of Professional Recording Equipment, organised by the APRS in the Connaught Rooms, Great Queen Street, Kingsway, London, on June 18-20 this year. The companies marked with an asterisk (*) were also present at the 66th AES convention in Los Angeles last month.

Acoustical Manufacturing Company Limited, Huntingdon, Cambs, PE18 7DB. Contact: P.J. Walker.

U.S. contact: not listed.

Main products: Quad amplifiers and electrostatic loudspeakers.

Example: *Quad 405 stereo power amplifier, 0.5 volt input* for 100 watts into 8 ohms, total harmonic distortion 0.01%, hum and noise -95dB 'A' weighted, unconditionally stable and fully protected by current limiters.

Price: £196.

***Allen & Heath/Brenell Limited,** Pembroke House, Campsbourne Road, Hornsey, London, N.8. Contact: Andrew Munro

U.S. contact: Audio Marketing Limited, 652 Glenbrook Road, Stamford, Conn. 06906.

Main products: SYNCON series and other portable consoles, compressors, delay systems and the Mini 8 tape recorder which forms the basis of an 8-track package for small studios.

Examples: *Mini 8 recorder,* 8-track on 1-inch tape, speeds 7½ and 15 ips, with full logic interlock, touch-sensitive switching, remote control, digital read-out counter. Price: £4,170.

SYNCON 24/24/4 console, modules combine input, output and monitoring sections, with master multitrack/remix selector, comprehensive solo system with monitor priority. Price: £11,152.

Alice (Stancoil Limited), 38 Alexandra Road, Windsor, Berks. Contact: Ted Fletcher.

U.S. contact: not listed

Main products: ACM (Alice Custom Modular) recording and broadcasting consoles.

Example: *ACM 16/8/16 console,* modular mixing system with subgroups, matrix routing of direct channel outputs (post fader) and group outputs, monitor pan, echo and sync foldback. Price: £6,000.

***Audio & Design Recording Limited,** 84 Oxford Road, Reading, Berks, RG1 7LJ. Contact: Michael J. Beville.

U.S. contact: Nigel Branwell, Audio Design Recording Inc., PO Box 786, Bremerton, Washington, 98310.

Main products: audio processors including the SCAMP (Standard Compatible Audio Modular Package), Compex-Limiters, Paragraphic Equaliser.

Examples: *E950-RS Paragraphic Equaliser,* has colour-coded pots for frequency and bandwidth, with six bands per channel stereo each covering four octaves, may be used in 12-section mode, e.g. for tight notching and tunable to any required frequency. Price: £810.

SCAMP rack-mounting modular system; user can choose from a range of modules including an Expander-Gate (£230), Compressor-Limiter (£220), Parametric Equaliser (£305); LED Quad-column PPM (£385), Pan Effects (£265) etc.

Audio Developments, Hall Lane, Walsall Wood, West Midlands, WS9 9AU. Contact: A. Levesley.

U.S. contact: Not listed

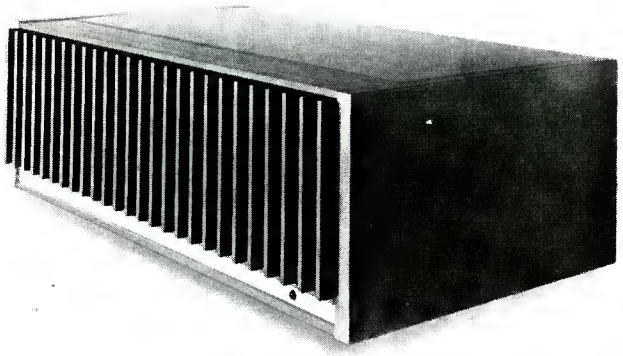
Main products: mains/battery consoles

Example: *Minimixer AD 007, 8/4 portable unit with comprehensive equalisation, oscillator, switched PPMs, compressor/limiters.* 12-channel extender available. Price: on application.

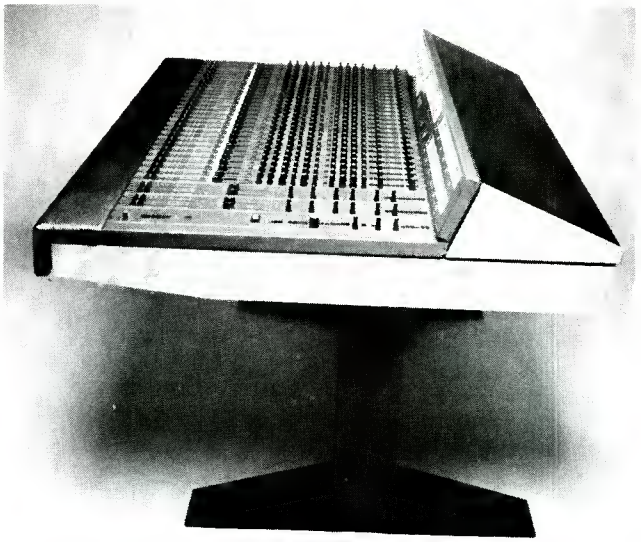
***Audio Kinetics (UK) Limited,** Verulam Road, St. Albans, Herts, AL3 4DH. Contact: I.M. Southern.

U.S. contact: Ian Dunn, Quintek Distributors Inc., 4721 Laurel Canyon Blvd., Suite 209, North Hollywood, Calif. 91607.

John Borwick is a freelance writer and author of "Sound Recording Practice."



Acoustical Manufacturing's QUAD 405 stereo power amplifier.



Allen & Heath/Brenell's 24-channel Syncon console.

Main products: synchronisers, autolocators, studio screens.

Example: *QLOCK 210,* a multi-microprocessor SMPTE/EBU timecode generator and synchroniser designed to locate and lock audio and/or video transports. It has cyclic sequence programming, SMPTE single-frame accuracy, drop-in and drop-out memories, 10 memory locate points, user-definable pre-roll, full remote controls and cascade feature to link two or more QLOCK systems for multi-machine work. Interfaces Ampex, 3M, Lyric, Sony, Studer, etc. Price: £5,800.

B & W Loudspeakers, Meadow Road, Worthing, Sussex, BN11 2RX. Contact: John Bowers.

U.S. contact: not listed

Main products: loudspeakers

Example: *Model 801 loudspeaker,* with 10½-inch bass driver, 4-inch mid-range and 1-inch tweeter, sensitivity 85dB for 1 watt at 1 metre at 300 Hz, minimum amplifier rating 50 watts, no upper limit due to automatic protection system giving levels up to 106dB, HF and mid-frequency environmental controls, separate angling on top of bass enclosure.

Price: £1075 per pair.

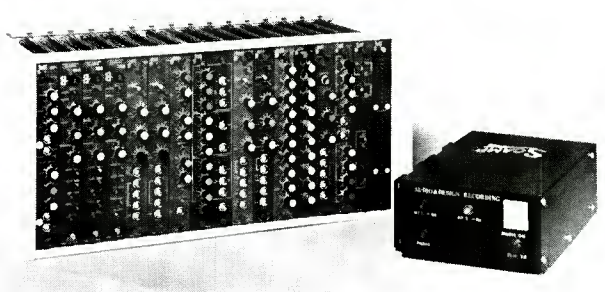
***C.A. Audio Systems, Ltd.** 141 Lower Luton Road, Harpenden, Hertfordshire AL5 5EL. Contact: Geoff Sore.

U.S. contact: Irv Joel, Joel Associates, 528 River Road, Teaneck, NJ 07666.

Main products: CADAC in-line series recording and remix consoles, Digicat fader system.

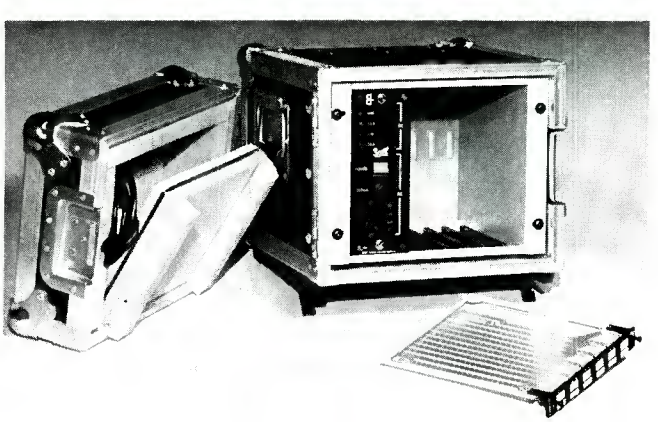
Price: on application.

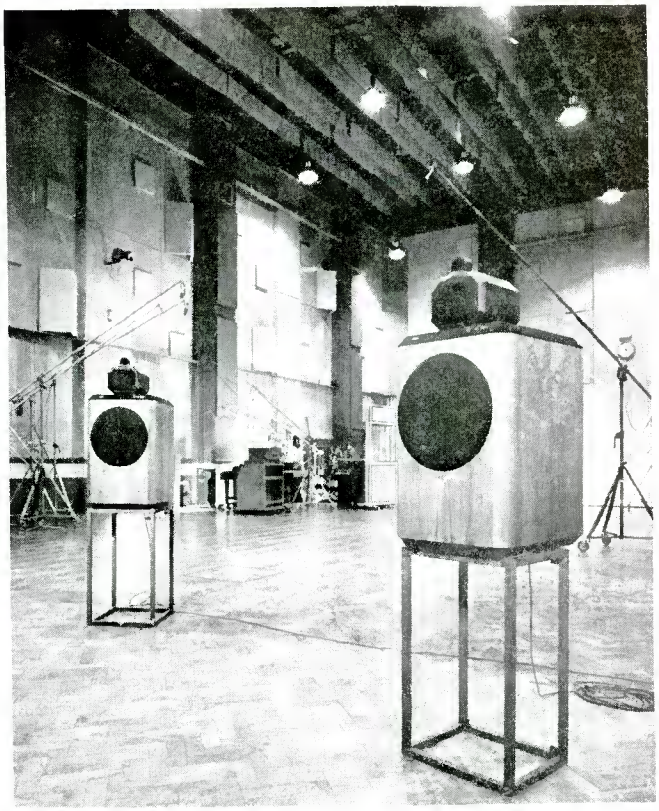
Audio & Design's SCAMP rack-mounting modular system.



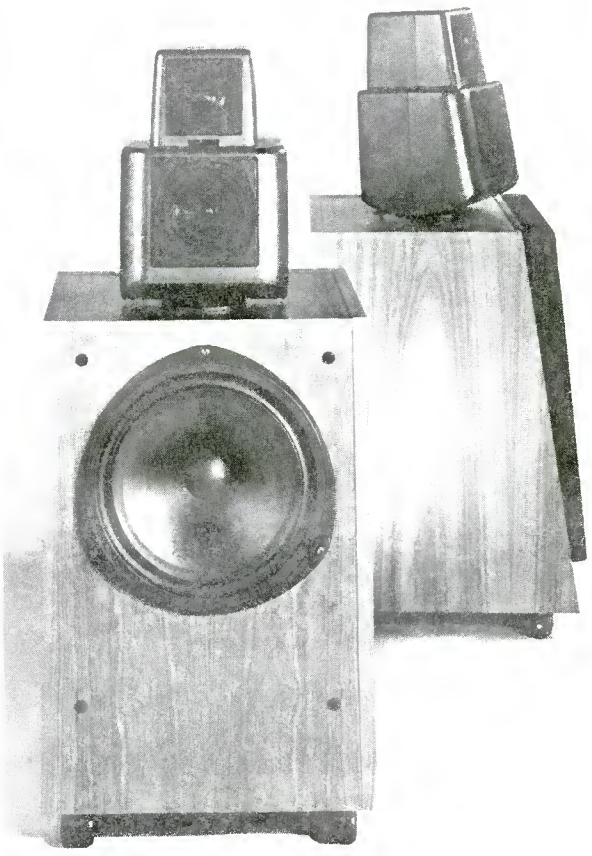
The 8-track, full-logic Mini 8 recorder from Allen & Heath/Brenell.

Flight case housing for Audio & Design Recording's mini-SCAMP.





B & W Loudspeakers Model 801, shown in EMI's Abbey Road Studio 1, where they have been chosen as monitors.



The KEF Reference Series Model 105 Series II.

***Calrec Audio Limited,** Hangingroyd Lane, Hebden Bridge, West Yorkshire, HX7 7DD. Contact: J. Howard Smith.

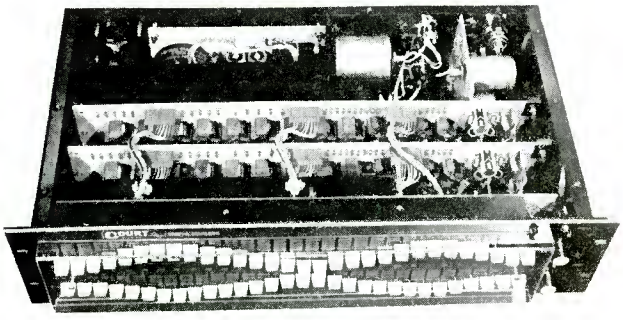
U.S. contact: Edcor, 16782 Hale Avenue, Irvine, Calif. 92714.

Main products: modular consoles, range of capacitor microphones, Soundfield microphone.

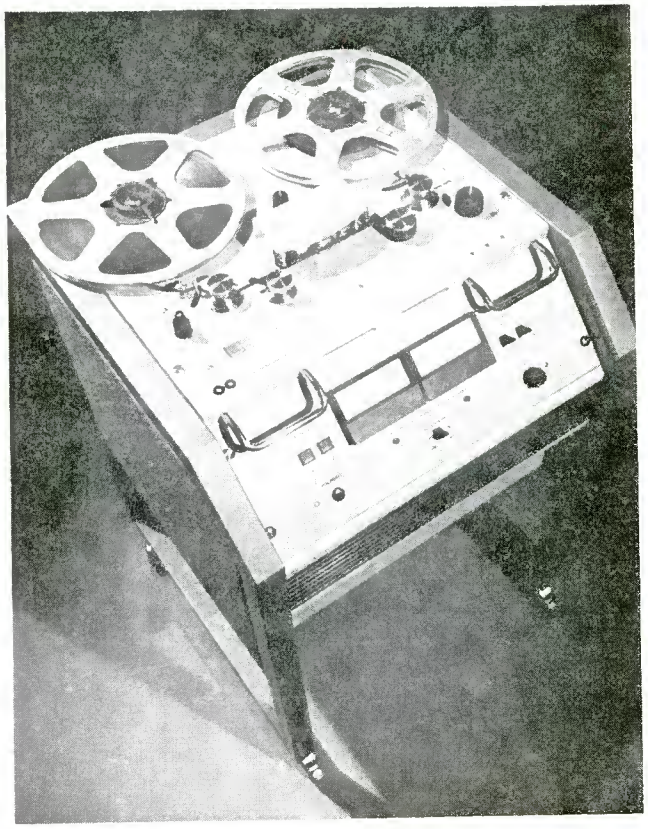
Example: *CM4050 Soundfield microphone,* with closely spaced array of four capacitor capsules forming a regular tetrahedron, in a single housing with mic preamplifiers. Multicore cable connects to control unit which produces four 'B-format' signals for direct recording or further encoding. Signals can be electronically panned or tilted, with polar responses equivalent to any first-order gradient characteristic.

Price: £2,600 complete with CS5014/3 Control Unit. (for more information, see **The Soundfield Microphone, db,** July 1978 and **The Ambisonics System, db,** August 1978—Ed.)

The Model SE 60 30-band, 1/3-octave stereo graphic equalizer by Court Acoustics.



The Leevers-Rich Proline Professional 1000 recorder.



Court Acoustics Limited, 35-39 Britannia Row, London, N1 8QH. Contact: Stephen Court.

U.S. contact: not listed

Main products: monitor speakers, spectrum analysers, graphic equalisers.

Example: *GE-30S graphic equaliser,* 2-channel, 30 bands 1/3-octave on ISO centre frequencies, control range +20dB to -10dB, noise -85dBm.

Price: £630.

***Design Electronics Limited,** 100 Chalk Farm Road, London, NW1 8EH. Contact:

U.S. contact: not listed

Main products: foldback systems

Example: *Cuemix foldback system,* cordless system which allows the musicians to mix five independent foldback sends to produce a personalised headphone balance; each signal can be assigned to left, right or centre.

Price: on application

Electronic Music Studio, John's Road, Wareham, Dorset. Contact: George Punnett.

U.S. contact: Everett Hafner, EMSA, 269 Locust Street, Northampton, Mass. 01060.

Main products: Synthi synthesizers, EMS Vocoders

Example: *Vocoder 1000,* compact model for live use, 16 filter sections with 16 envelope followers and modulators, internal pulse oscillator and noise generator.

Price: £750.

H/H Electronic, Viking Way, Bar Hill, Cambridge, CB3 SEL. Contact: J.M. Harrison

U.S. contact: Audio Marketing Limited, 652 Glenbrook Road, Stamford, Conn. 06906.

Main products: amplifiers, PA loudspeakers, echo units

Example: *S500-D stereo power amplifier,* 0.75 volt for 300 watts into 4 ohms, total harmonic distortion 0.02%, noise 105dB below 180 watts into 8 ohms, fully protected electronically and thermally.

Price: on application

***KEF Electronics Limited,** Tovil, Maidstone, Kent. Contact: Raymond E. Cooke

U.S. contact: Robert Demetro, KEF Electronics Ltd., c/o Intratec, P.O. Box 17414, Dulles International Airport, Washington, DC 20041.

Main products: loudspeakers

Example: *Model 105 Series 2 loudspeaker,* with 12-inch bass unit, 5-inch mid-range and 2-inch tweeter, sensitivity 85dB for 1 watt pink noise at 1 metre, power handling 200 watts programme rating, 107dB maximum spl output on programme peaks, 'S—STOP' electronic protection, LED level indicator switchable to 50 to 200 watts, LED listening window indicator, mid-range and tweeter in separate enclosure for angling on top of bass enclosure.

Price: £700 per pair.

***Keith Monks (Audio) Limited,** 26-28 Reading Road South, Fleet, Aldershot, Hampshire GU13 9QL. Contact: T.K. Monks

U.S. contact: Keith Monks Audio (USA) Inc., 652 Glenbrook Road, Stamford, Conn. 06906.

Main products: microphone stands, splitter boxes, record cleaning machines.

Example: *CR500 semi-professional record cleaning machine,* scrubs the record with a mixture of alcohol and distilled water, and in the same movement, a vacuum pump/nozzle removes all liquid and dirt; disc is left clean and dry.

Price: £260.

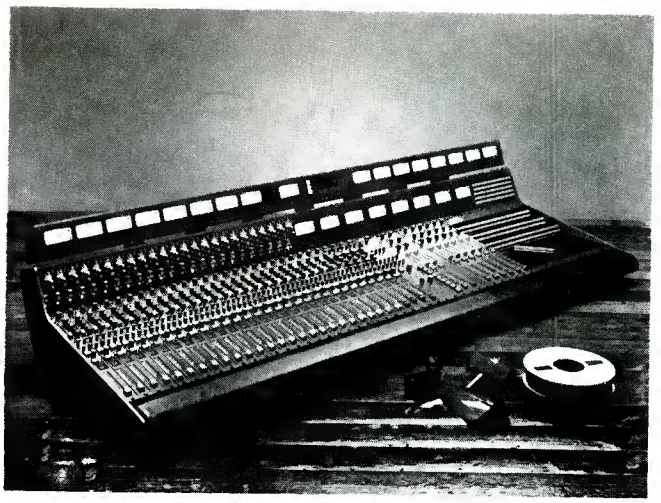
***Klark-Teknik Research Limited,** Walter Nash Road, Kidderminster, Worcs. DY11 7RE. Contact: P.M. Clarke

U.S. contact: Russ Posser, Hammond Industries Inc., 155 Michael Drive, Syosset, NY 11791.

Main products: graphic equalisers, digital time processors.

Example: *DN27 graphic equaliser,* single-channel, 27 brands 1/3-octave on ISO centre frequencies, control range ±12dB, noise less than -90dBm.

Price: £495.



The Midas PR System console featuring 26 Pro 3C input modules having 3-band equalizers, PFL, mute, pan, and in-place solo.

Featuring one or two-tracks on ¼-inch tape, full logic control, varispeed, remote control, variable spooling speed, and led elapsed time display, the Studio 8 recorder from Neal Ferrograph boasts many interesting applications.

The Solid State Logic SL 4000E Series console.

Leevers-Rich Limited, 319 Trinity Road, Wandsworth, London, SW18 3SL. Contact: Tony Costello

U.S. contact: not listed

Main products: tape machines, bulk erasers, digital clocks

Example: *Proline 2000TC recorder,* 1 or 2 tracks on ¼-inch tape, speeds 3¾/7½, 7½/15, 15/30 ips, full TTL logic interlock, twin DC servo-controlled capstans with crystal reference, varispeed run and spooling, LED timer display, plug-in headblock and modular electronics.

Price: on application

Maglink Audio Products Limited, 17 Erncroft Way, Twickenham, Middlesex, TW1 1DA. Contact: D. Hopkins.

U.S. contact: not listed

Main products: sychronisers for audio, video and sprocketed machines of all types.

Example: *Maglink Multi-Machine System,* an expandable synchronising system using the Maglink timecode (a lower rate than SMPTE but can be made compatible with EBU/SMPTE). Basic system has one master and one slave, but up to four extra slave cards can be added. Features location display switchable for various video or film formats, display hold, searching, programme cue, advance or retard, repeat function, built-in timecode generator.

Price: basic one slave £9,650, extra slaves £1,400 each.

Midas Audio Systems Limited, 54-56 Stanhope Street, London, NW1 3EX. Contact: David Solari

U.S. contact: (Canada) Frank Pimiskern, Gerr Electro-Acoustics, 365 Adelaide Street East, Toronto, MSB 4R9

Main products: PR system consoles and portable mixers for live sound reinforcement, TR system for theatre sound.

Example: *PR 26/8-24 recording console,* with 26 PRO3C input modules having 3-band equalisers, PFL, mute, pan, in-place solo. Modules are complete with XLR connectors at rear, frames hold six modules each.

Price: £20,372.

***NEAL-Ferrograph,** North East Audio Limited, Simonside Works, South Shields, Tyne and Wear, NE34 9NX. Contact: A.J. Helliwell

U.S. contact: Neal-Ferrograph (USA) Inc., 652 Glenbrook Road, Stamford, Conn. 06906.

Main products: tape machines, cassette decks, test instuments.

Example: *Ferrograph Studio 8 recorder,* 1 or 2 tracks on ¼-inch tape (0.15-inch to special order), speeds 3¾/7½ or 7½/15 ips, full logic control with motion sensing, varispeed, remote control, variable (preset) spooling speed, LED elapsed time display.

Price: from £2,800 transportable, £3,495 console version, £2,995 penthouse version.

Neve Electronics International Limited, Cambridge House, Melbourn, Royston, Herts, SG8 6AJ. Contact: D.A. Tilsley.

U.S. contact: Anthony H. Langley, Rupert Neve Inc., Berkshire Industrial Park, Bethel, Conn. 06801.

Main products: consoles, portable mixers, NECAM computer assisted mix-down system

Example: *Neve 8024 24/24/4 console,* with 24 fully equalised input channels, 24 recording and 4 main mixed outputs, 8 auxiliary outputs, 4 reverb returns, quad panning on all channels, full metering, oscillator, etc.

Price: on application.

***Raindirk Limited,** 33A Bridge Street, Downham Market, Norfolk. Contact: Cyril Jones.

U.S. contact: not listed.

Main products: audio consoles,35mm dubbing consoles.

Example: *Concord S2000 20/16/16 console,* with combined input/output/monitor modules, solid state central status switching, four-band equalisation, including two mid-range sweep, oscillator etc.

Price: on application.

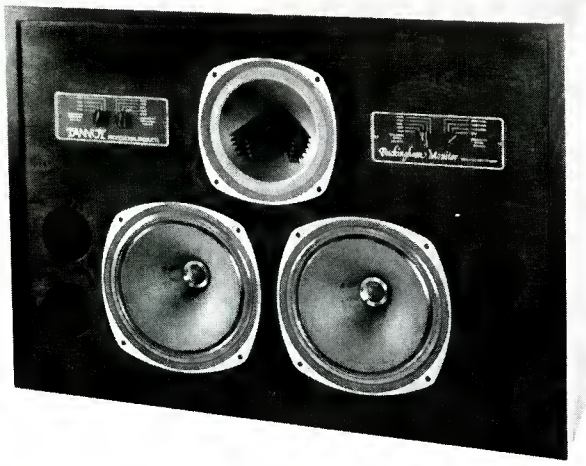
***Solid State Logic Limited,** Church Road, Stonesfield, Oxford, OX7 2PS. Contact: Colin Sanders.

U.S. contact: Douglas F. Dickey, Washington Music Works Inc., 3421 M Street, NW Washington DC 20007.

Main products: consoles, computer controls.

Example: *SL-4040-32BG 32-channel console,* automated, computer-controlled, with full logic control of major console states, comp/limiter/expander/noise gate on each channel and 14-control parametric equaliser with four bands, monitoring

Soundcraft Electronics SCM 381 16-track recorder in a new 2-inch tape version.



Tannoy's Dual Concentric Buckingham Studio Monitor handles 1 kilowatt of power.

The Trident TSM Series console featuring 24-inputs with fully removable modular patchbay.

at three separate points, two independent subgrouping systems, eight VCA subgroups, pretimed automatic fader 1-60 seconds. Options for computer system, with level memory, editing and record keeping, 100-step plasma display meters, with peak hold etc.

Price: £79,592, SSLL computer £16,255.

***Soundcraft Electronics Limited,** 9-10 Great Sutton Street, London, ECiV OBX. Contact: P.S. Dudderidge.

U.S. contact: Gregory M. Hockman, Soundcraft Electronics Ltd. (North American Div.), 2025 Factory Street, Kalamazoo, Mich. 49001.

Main products: modular consoles, multitrack tape machines.

Examples: *SCM381-8/16 recorder,* 8 or 16 tracks on 1-inch tape, speed 15 ips, with removable front panel for remote control, real time digital counter, varispeed, capstan drives outside of tape, sync output.

Price: £5,250 8-track, £7,500 16-track, £9,500 new 16-track 2-inch tape version.

Example: *Series 3B 24/24 console,* fully modular, using proprietary transformerless mic amp with almost theoretically minimum noise level, sweepable 4-band equaliser, 8 auxiliary buses, 24-segment LED ladder-display VU/PPM.

Price: £11,950.

The Vitavox Thunderbolt speaker system.

***Tannoy Products Limited,** St. John's Road, Tyler's Green, High Wycombe, Bucks, HP13 7BX. Contact: Norman J. Crocker.

U.S. contact: Henry A. Roed, Jr., Tannoy-Ortofon Inc., 122 Dupont Street, Plainview, NY 11803.

Main products: loudspeakers, dividing networks.

Example: *Buckingham Monitor loudspeaker,* with two 12-inch bass units and a 10-inch Dual Concentric driver, sensitivity 94dB for 1 watt at 1 metre over range 40 Hz to 20 kHz, long term power rating 150 watts continuous, peak 1,000 watts.

Price: £2,450 per pair.

***Trident Audio Developments Limited,** Shepperton Studio Centre, Squires Bridge Road, Shepperton, Middlesex. Contact: Malcolm Toft.

U.S. contact: Dave Michaels, Studio Maintenance Services, 12438 Magnolia Boulevard, North Hollywood, Calif. 91607.

Main products: studio consoles, Fleximix theatre consoles.

Example: *TSM 40-24-32 console,* with fully removable modular patchbay, separate modules for equaliser section, signal routing and all other signal processing, bi-fet operational amplifiers, no relays, four-band graphic parametric equalisers plus swept high and low pass filters, oscillator, comprehensive monitoring with equalization and switching of monitor module outputs to remix bus allows up to 72 mixable inputs on this 40-24-32 version.

Price: £48,000.

Tweed Audio, Pinnacle Hill Industrial Estate, Kelso, Roxburghshire, Scotland.

U.S. contact: K. Mustafa, Tweed Audio USA Inc., 1640 Fifth Street, Santa Monica, CA 90401.

Main products: audio and broadcast consoles.

Example: *B1302 broadcast console,* four mic channels, two auxiliary with equalisation, PFL and pan, presenter mic channel with limiter and voice over, two stereo gram channels, off-air monitoring, talkback, four PPMs.

Price £4,472.

Vitavox Limited, Westmoreland Road, London, NW9 9RJ. Contact: Neil Young

U.S. contact: not listed

Main products: PA, stage and monitoring loudspeakers

Example: *Thunderbolt loudspeaker system,* a two-way all horn loaded system, with 15-inch driver on 8-feet long folded bass horn and a pressure driver on a four-cell dispersive horn, crossover at 500 Hz, rating 100 watts to give 132dB spl at 1 metre.

Price: £770. ■

JOHN WORAM

Books on Architectural Acoustics For The Would-Be Studio Designer

When designing a recording studio, don't let budgets totally dominate your plans. There are many affordable alternatives—so look before you leap.

WHEN IT COMES TO RECORDING STUDIO DESIGN, architectural acoustics may mean just about anything, from a few sheets of fiberglass-on-plywood, to a million dollar treatment. Aesthetics may, or may not, play an important role as well.

Years ago, many studios were designed to be functional, with little or no attention paid to appearances. In those days, "ambience" referred to reverberation time; today, lots of attention is usually paid to appearance, and ambience is now used to describe the studio decor. As for reverberation time, there probably isn't any (well, almost).

The best of the early studios may not have been designed to be studios at all. For example, New York's famed Webster Hall was much in demand for recording sessions, yet it started out as a dance hall, complete with stage and an ornate revolving chandelier. Mirrored walls and a balcony around three sides contributed to the ambience.

RCA built a small control room in Webster Hall, and despite three specially built recording studios "uptown" on 24th Street, many artists preferred the musical ambience of Webster Hall to the functional designs of the home-office studios. When the company moved to its present home on Sixth Avenue and 44th Street, it abandoned Webster Hall. Actually, it wasn't very practical as a recording studio. Sessions were frequently interrupted, as trucks passed by the open windows (no air conditioning), or, when a cantankerous radiator began acting up. But what a sound! (The ambience that is, not the radiator.)

Today of course, engineers and producers strive for a different kind of "sound"—one that is often created in the control room, not in the studio. Webster Hall-type sound is no longer in demand, and although some lament the passing of an era, today's requirements may be just a bit easier to meet. At least nowadays, studios do not have to be as big as basketball courts.

However, the nature of sound remains just as complex as ever, and the would-be studio builder is well-advised to proceed with caution. Although reverberation has given way to isolation, still the science (or art) of architectural acoustics may not be mastered in ten easy-to-follow lessons.

Of course, there's no substitute for seeking expert help, yet many do not have the budget that may be required to call in the experts. Fortunately, there are now a number of books on the subject. While no substitute for professional help, they may make life just a bit easier for the do-it-yourself'er.

THE BASICS

How to Build a Small Budget Recording Studio from Scratch by F. Alton Everest, 336 pages, $12.95 hardcover, $8.95 paperback, TAB Books.

According to the preface, "This book is about small studios, how to build them and how to treat them acoustically." And so it is, with the emphasis on keeping the budget within reason. There are chapters on building studios in the home and in the garage, and although none of the treatments may compete with the mega-buck studio downtown, the beginner may find a tip or two that will help in converting a small available space into a serviceable recording environment.

An earlier book by the same author (Acoustic Techniques for Home and Studio) was reviewed in the February, 1974 Sync Track column in **db**.

In the same column, the single-volume second edition of Michael Rettinger's Acoustic Design and Noise Control was also reviewed. In 1977, an expanded third edition was published in two volumes. Volume I is Acoustic Design, and Volume II is Noise Control. But don't sell your old second edition, for the first chapter on the physics of sound has not been carried over into the new edition, which now begins with an expanded chapter on room acoustics. Additional material includes an eight-page section on sound-absorptivity measurements. Also, formulas have been added for metric-system measurement of reverberation time. The two-volume edition contains about 100 more pages than the single-volume second edition.

MORE ON NOISE CONTROL

For those with an interest in architectural acoustics in the recording studio, an in-depth treatise on noise control may seem to be a little bit far-afield. However, the following three anthologies supply a wealth of information on specialized aspects of noise control. One or more of the articles may deal with a specific problem faced by—and therefore of interest to—the studio designer.

Handbook of Noise Control, Cyril M. Harris, editor, 720 pages, $39.50, McGraw-Hill.

John Woram is the editor of **db Magazine,** *principal of Woram Audio Associates, and author of the "Recording Studio Handbook."*

45 chapters on every aspect of noise. Terminology. Sound Levels, Noise Measurements, as well as chapters on noises created by ventilating systems, motor vehicles, construction equipment, etc. D. Lipscomb & A. Taylor, Jr., editors.

A 23-page index makes life a lot easier for the researcher. Noise Control: Handbook of Principles and Practices, 375 pages, $23.50, Van Nostrand Reinhold.

After introductory chapters on the nature of sound, sound levels and noise assessment, principles of noise control and acoustical treatment are covered. Industrial, aircraft and highway noise are reviewed, as are noise control legislation and control of noise in the home.

Handbook of Noise Assessment, D. N. May, editor, 400 pages, $22.50, Van Nostrand Reinhold.

This anthology assesses the psychological and physical effects of noise, from basic subjective responses, to noise and sleep, and the effects of noise on work efficiency.

MORE ON ARCHITECTURAL ACOUSTICS

Architectural Acoustics, T. D. Northwood, editor, 428 pages, $30.00, Halsted Press.

Like the three noise anthologies, this is a compendium of papers by various authors, previously published in selected technical journals. Of the 30 papers presented here, 25 are in English, four are in German, and one is in French. The collection is certainly valuable for its treatment of room acoustics and sound insulation, but it is unfortunate that the German and French papers are not translated in full. For example, H. Haas' famous *The Influence of a Single Echo on the Audibility (Perceptibility) of Speech* is given a too-short English summary following the complete paper in its original German. For a complete translation, see the *Journal of the Audio Engineering Society*, volume 20, number 2 (January, 1972).

BRIEFLY NOTED

Handbook of Acoustical Enclosures and Barriers, by Richard Miller and Wayne Montone, 250 pages, $29.95, Fairmont Press.

Although the enclosures and barriers described are not those found in the recording studio, the basic principals of treatment for acoustical walls, ventilation systems and design guidelines for barriers may be applied in the studio, as well as in the office or factory.

Concepts in Architectural Acoustics, by M. David Egan, 200 pages $16.50, McGraw-Hill.

Our brief 1974 review is reprinted here in its entirety. This volume contains remarkably little written material. Instead, the information is presented in the form of graphs, illustrations, and tables. Here and there, a page or two of text offers some supplementary information. The format places a considerable amount of data at the ready disposal of the reader who is seeking "how to," rather than "why."

CALLING IN THE SPECIALISTS

For those who can afford it, a good consultant is a sound investment (pun and all). And, if you've read one or more of the books just reviewed, you may be more than ready to call for help. Your specialty is recording—the consultant's is architectural acoustics. The two are not synonymous, as many have learned the hard way. Just because you get great drum sound does not mean you can also keep that drum sound out of the neighboring offices. Before you try, re-examine your budget, and see if there's a way to get a little professional help.

THERE'S CONSULTANTS—AND THEN, THERE'S CONSULTANTS

The professional consultant sells nothing, except his services. He won't recommend which tape recorder to buy, or the right microphones for those drums. His business is architectural acoustics, and not selling hardware. Theoretically, that makes him your first choice, although in practice you may prefer dealing with one of the well-known companies that supply turnkey studio packages, from acoustic design to hardware delivery.

If you're thinking of re-modelling a former warehouse next door to a machine shop and just down the road from the railroad depot, find yourself a good Consultant, with a capital C. Your first problem is keeping the music in and the noise out. Later on, you can find someone to help you select the wood trim to compliment the console. If your adviser is thinking about all that great hardware he's going to sell you, you may not be getting the best possible advice.

On the other hand, the turnkey company may have a long list of successful studios to its credit. If so, try to find one that had the same type of problems you are facing. If the studio manager is still on speaking terms with your potential advisor, you're probably in good hands.

NATIONAL COUNCIL OF ACOUSTICAL CONSULTANTS

Membership in this organization requires—among other things—that the consultant is not associated with the manufacture or sale of any product if such association could jeopardize, tend to jeopardize or give the impression of jeopardizing the ability to render independent unbiased decisions regarding product specification or related matters. Additionally, Council members must be full members of the Acoustical Society of America.

The Council publishes a 34-page Directory of Member Firms, and these are listed alphabetically and geographically. The directory includes a membership profile of each firm, listing company principals, services offered, typical projects and other general data. The directory costs $2.50, and is available from NCAC headquarters at 66 Morris Avenue, Springfield, New Jersey 07081. ■

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A message from the Crime Prevention Coalition, this publication and The Ad Council.

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FOR SALE: B & K 2305 chart recorder, IVIE IE10A octave band analyzer. **Richard Cabot, 12820 S.W. Washington, Beaverton, OR 97005. (503) 644-9727.**

AMPEX, OTARI & SCULLY recorders in stock for immediate delivery; new and rebuilt, **RCI, 8550 2nd Ave., Silver Spring, MD 20910.** Write for complete product list.

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FOR SALE MCI 428B CONSOLE, 16 I/O Modules. Mainframe 28-in, 24-out. Perfect condition. $18,500.00. Also, matching custom formica producer's desk/equip. rack—$600.00. **Westwood Recording Studios (602) 622-8012.**

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db People/Places/Happenings

• **The Signal Companies** and **Ampex Corporation** today mutually agreed to **terminate negotiations** for the merger of Ampex into Signal through an exchange of common stock. The merger negotiations were terminated due to economic conditions and depressed stock market prices. Previously the two companies announced an agreement in principle which called for the exchange of 0.79 Signal common share for each common share of Ampex.

• **UREI,** manufacturer of professional audio products, has appointed **Bruce Marlin** to the post of assistant sales manager. Marlin came to UREI with a wide background in the professional sound industry. His most recent position was as sales manager for **Westlake Audio** in Los Angeles. Marlin will have sales responsibilities in all areas of UREI's business including the professional recording and broadcasting industries.

• **Bill Hamilton** has been appointed eastern regional sales manager for **James B. Lansing Sound, Inc.'s** professional products division. He will supervise all sales activities for JBL professional products in the Northeast, Mid-Atlantic states and the Southeast. Prior to joining JBL, Hamilton held a variety of key executive and sales management positions in pro audio, including president of **L & H Sound Recording Studios,** marketing vice-president for **Gately Electronics,** and most recently, eastern regional sales manager for **Scully Dictaphone Corporation.**

• **Phil Sun** has been appointed national service manager of **Otari Corporation,** San Carlos, CA the U.S. branch of the international tape recorder manufacturing company. Sun comes to Otari from **Accurate Sound Corporation** where he was vice president of manufacturing. Otari selected Sun for this key position because of his extensive experience in the repair and modification of all brands of professional tape recorders and his design skills in tape duplicator manufacturing.

• **Studiomedia Enterprises Incorporated** has opened an innovative recording complex in Evanston, Illinois. The new facility has a state-of-the-art 24-track studio, an 8, 4 and 2-track production, and a live room shared by both control rooms. The studios are built around a revolutionary design that places the engineer/producer in the optimum position for monitoring the most direct sound. The studio, designed by **Jerry Milam** of **Milam Audio,** is one of the few studios in the country currently employing this design. The entire space was built for comfort and prime working conditions, with a kitchen, shower, lounge, conference room and offices. Equipment includes MCI tape machines, Neotek console, Dolby A noise reduction and UREI monitor systems. Instruments include the new Baldwin SF-10 7-foot concert grand, full drum set, Rhodes stereo 88, and synthesizers.

• **ListenUp Professional Division** reports they produced a live show March 26th featuring **"38 Special."** The concert was broadcast to fifteen FM radio stations across the United States and recorded 16 track in their new control room at the **Rainbow Music Hall.** The concert will first be released on a limited broadcast disk. Engineering was handled by **Norm Simmer** and with **Thomas Lang** assisting. Some other broadcast/recordings to date are: **Sue Saad and the Next, Rachael Sweet, Stillwater, The Cretones, The Fools, Angel City,** and **Elvin Bishop.**

• **McMartin Industries, Inc.** recently announced the appointment of two new operations managers. **Robert J. Anderman** has been appointed director of domestic operations. He formerly served as broadcast sales manager for McMartin. Anderman first joined McMartin in 1976. **Ron Briggs** has been promoted by McMartin to director of international operations. He first joined the company in 1979 as international contract and sales administrator. He will supervise all overseas marketing. Briggs brings to the job an extensive background in foreign sales.

• **BASF Systems** has promoted **Robert Donadio** to Director of Research and Development. Donadio had been employed by BASF as manager of their technical development department. He developed BASF's 8-track lubricated tape formulation and, more recently, an improved tape formulation known as **DPS.** He has also supervised the beginning phase of **Flexydisk** and video tape production as well as the implementation of advanced computer tape formulations. Donadio joined the company in 1964.

• **dbx, Inc.** of Newton, Mass. and **Crystal Clear Records** of San Francisco have announced plans to issue albums from the Crystal Clear catalog in the **dbx Encoded Disc** format. The initial offering of dbx Encoded Discs will include Volumes I and II of **Sonic Fireworks** (a collection of music for organ, brass and percussion), **New Directions** by **Laurindo Almeida** and **Taj Mahal Live.** The dbx process virtually eliminates record surface noise while reproducing the full dynamic range captured on the master tape. Coupled with a proper decoder, the discs can be played through any stereo system.

• **Anixter-Pruzan** has announced the appointment of **Cal Edinger** who previously was sales manager in St. Louis, to manager of the St. Louis District. Cal joined Anixter three years ago after previous experience in the Communications Division of **Graybar Electric.**

• **Earth Audio Techniques, Inc.,** is a 16-track MCI recording studio located in North Ferrisburg, Vermont, in a renovated barn on 26 acres of beautiful countryside. Engineers **Mike Couture** and **Chas Eller** have recently completed work on the debut LP of jazz group, **Kilimanjaro,** of which Chas is the keyboard player. Other projects include a new offering from **The Davis Brothers** whose single: "Looking for the Money" proved to be a large hit in England. Also, **Mary McCaslin's** latest album "Sunny California" was recorded at Earth Audio's facilities.

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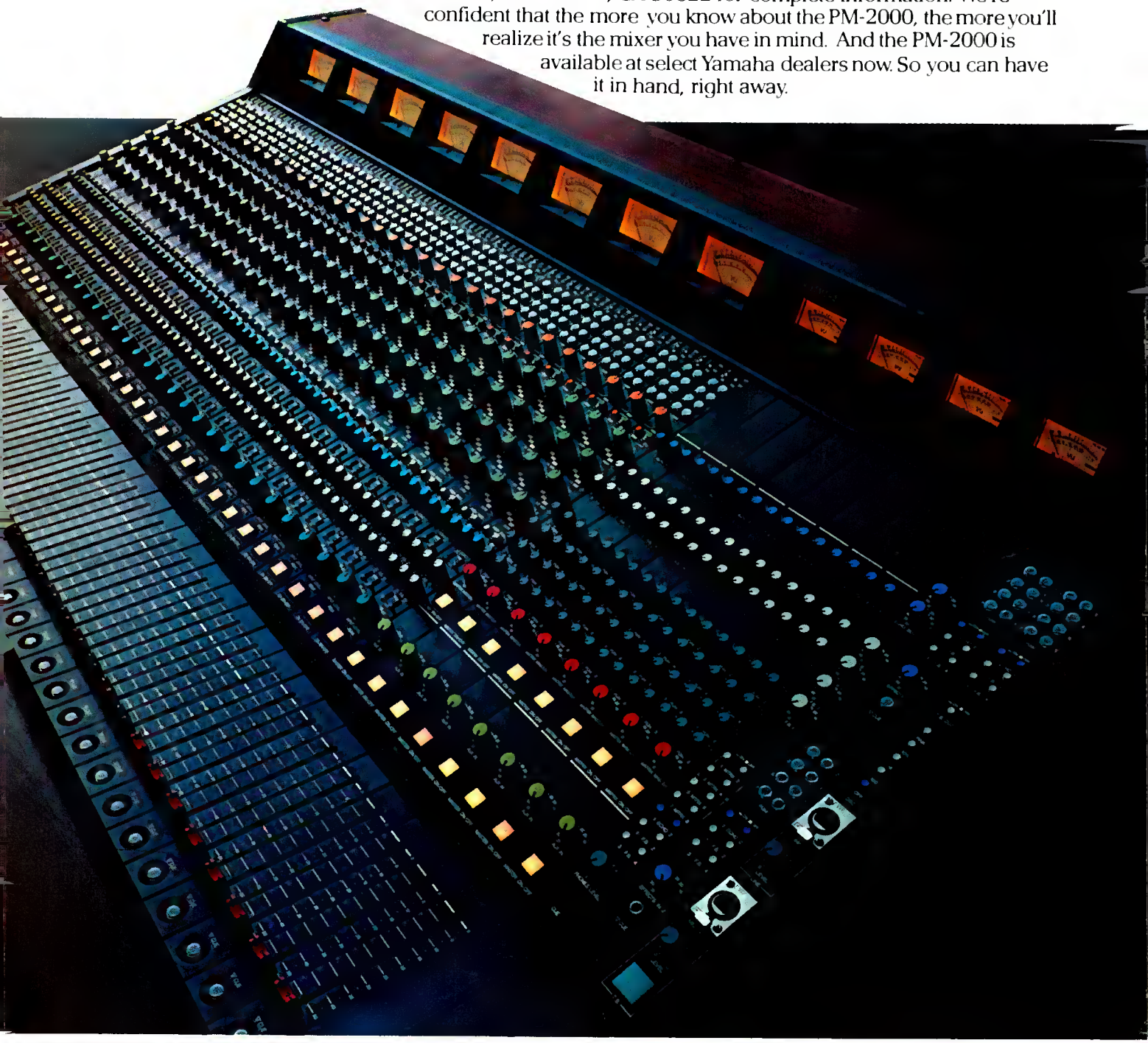

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AMPEX ATR-100. TOP-OF-THE-LINE PERFORMANCE IN A 2 OR 4 TRACK RECORDER.

When your mastering job requires a lot of performance, the Ampex ATR-100 is your logical choice. The ATR-100 has the same unsurpassed ATR series electronics and tape transport system found in the most advanced multitrack recorder on the market today, our new ATR-124. You get sound quality for mastering and playback unmatched by any competitive recorder.

Features and specs you'd expect from Ampex. You also find specifications that have made the ATR-100 a recognized standard of excellence for the industry. Extremely low distortion, exceptional electronic headroom, low wow and flutter, and phase corrected record equalization pushes the performance of any tape to its maximum. And that means better sounding results.

When time is of the essence, ATR-100 gives you more time. ATR-100's quick start and stop transport time lets you go from rewind (2400 ft. in under 45 seconds) to play mode in 4.8 seconds. And up to 20 cue locations can be programmed onto the tape with the optional multi-point search-to-cue accessory for additional creative time savings. The transport system of the ATR-100 is unsurpassed by any competitive model in terms of accuracy and precision. Feature after feature that makes outstanding performance an everyday occurrence. The Ampex ATR-100. Contact your Ampex sales representative for complete details.

AMPEX MAKES IT EXCITING

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